United States Department of the Interior

FISH AND WILDLIFE SERVICE

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Dear Interested Party: June 19, 2002

Enclosed is the final Environmental Assessment (EA), Finding of No Significant Impact (FONSI) and a Compatibility Determination (CD) on the Bear Valley National Wildlife Refuge Fire Hazard Reduction Project.

The EA analyzes the implementation of a plan for reducing the fire hazard in the refuge. Due to overstocked forest conditions and an accumulation of woody fuels, adjacent property owners and the biological resources of the refuge are at risk from high intensity, high severity wildfires. The FWS proposes to reduce hazardous fuels on 2,400 acres of the refuge. A combination of mechanical and prescribed fire treatments will be used. The project will also promote the development of preferred nesting and roosting trees for the bald eagle.

Other alternatives evaluated in the assessment included conducting fire hazard reduction on the refuge without the use of prescribed fire, and adhering to current management practices (no action).

Public comments on the draft EA were accepted through April 22, 2002. They are addressed in Appendix A. The Klamath Basin Refuges greatly appreciates the input of those who participated.

If you have any questions, feel free to inquire.

Sincerely,

Phil Norton
Refuge Manager

Bear Valley National Wildlife Refuge
Fire Hazard Reduction Project

Final Environmental Assessment
June 18, 2002

Master Copy.

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Chapter 1 - Purpose and Need

1.1 Introduction

This Environmental Assessment (EA) documents the results of a study of the potential environmental impacts of actions proposed by the U.S. Fish and Wildlife Service to reduce the fire hazard and restore forest stands for roosting and nesting bald eagles at the Bear Valley National Wildlife Refuge.

This EA has been prepared in compliance with:

- The National Environmental Policy Act (NEPA) of 1969 (42 United States Code (USC) 4321 et seq.), which requires an environmental analysis for major Federal Actions having the potential to impact the quality of the human environment;
- Council of Environmental Quality Regulations at 40 Code of Federal Regulations (CFR) 1500-1508, which implement the requirements of NEPA;
- US Fish and Wildlife NEPA Policy Handbook (550 FW 1)
- National Wildlife Refuge System Improvement Act, 1997

The Purpose of an Environmental Assessment (EA)

An EA study is performed by a Federal agency to determine if an action they are proposing to implement would significantly affect any portion of the environment.

The intent is to provide project planners and Federal decision-makers with relevant information on a Proposed Action's potential impacts to the environment.

If the study finds no significant impacts, then the agency can publish a Finding of No Significant Impact (FONSI) and can proceed with the action. If the study finds there would be significant impacts, then the agency must prepare and publish a detailed Environmental Impact Statement to help determine how to proceed with the action.

Key objectives of NEPA are to help Federal agency officials make well-informed decisions about agency actions and to provide a role for the general public in the decision-making process. The study and documentation mechanisms associated with NEPA seek to provide decision-makers with sound knowledge of the comparative environmental consequences of the several courses of action available to them. NEPA studies, and the documents recording their results, such as this EA, therefore focus on providing input to the particular decisions faced by the relevant officials. In this case, the Manager of the Klamath Basin National Wildlife Refuge Complex is faced with a decision as to what, if anything, the Fish and Wildlife Service should do to reduce the fire hazard and restore forest stands at Bear Valley National Wildlife Refuge, as described below. This decision will be made within the overall management framework already established in the Klamath Basin National Wildlife Refuge Complex Wildland Fire Management Plan and the Bear Valley National Wildlife Refuge Habitat Management Plan for Bald Eagles. These plans establish overall rules and guidance for fire management and forest stand restoration-related actions taken within the refuge. Therefore, the alternative courses of action considered in this EA were crafted to be consistent with the concepts established in them.

1.1 *Background*

The Bear Valley National Wildlife Refuge is one of 6 refuges that comprise the Klamath Basin National Wildlife Refuge Complex in south central Oregon and north central California. Bear Valley is located approximately 13 miles southwest of Klamath Falls, Oregon and 2 miles west of Worden, Oregon (see Figure 1-1). It is bordered by Oregon Department of Forestry lands, public lands managed by the Bureau of Land Management, and private lands. The refuge is adjacent to a rapidly developing rural interface community. Small ranches, farms, and developing sub-divisions are scattered along the north, east and southern boundaries. The Hamaker Mountain Federal Aviation Administration Radar Facility is located approximately ¾ mile to the west of the refuge.

The Refuge was established to preserve an important winter communal roost area for bald eagles (*Haliaeetus leucocephalus*) in the Klamath Basin. In some years, over 1,000 bald eagles have wintered in the Klamath Basin, constituting one of the largest concentrations in the lower 48 states. As much as 64% of the entire wintering population in the Basin utilizes the roost at Bear Valley between mid-November and April. Four distinct core roosting areas, or subroosts, have been documented at Bear Valley National Wildlife Refuge (Dellasala et. al., 1987). The refuge also has 3 active bald eagle nests.

The management goals for the Bear Valley National Wildlife Refuge focus on the preservation and enhancement of bald eagle roosting habitat. These goals are to maintain the health and vigor of the existing bald eagle roost trees, and to create forest stand conditions that will provide for additional bald eagle roosting habitat needs in the future.

In recognition of the wildland fire hazard to the roost sites and forest health issues, the Fish and Wildlife Service undertook steps in 1996 to thin portions of the refuge that contained roosting sites or that were adjacent to the roosting areas. Of an initial treatment goal of approximately 1,800 acres, which included the core of the four subroosts in the refuge, 246 acres have since been thinned and prescribed burned. Additional thinning and prescribed fire treatments are under consideration for the remaining 1,544 acres identified in 1996.

1.2 Purpose and Need

The U.S. Fish and Wildlife Service proposes to implement a plan to reduce the wildland fire hazard on the remaining acreage, approximately 2,400 acres, within the Bear Valley National Wildlife Refuge, as well as promote forest stand restoration for roosting and nesting bald eagles. The objectives of the plan are to:

- provide a margin of protection to neighboring residences from future wildfires;
- reduce the likelihood of catastrophic fire destroying the subroosts in the refuge;
- help restore and maintain the health of forest stands;
- promote a more rapid restoration of forest stand characteristics that would benefit future bald eagles nesting and roosting habitat (large trees)

The existing high fire hazard on the refuge is the result of fire exclusion by management and vegetation management by commercial logging, circa 1920-1970. As a result of fire suppression efforts over the past 80 years, much of the refuge contains overly dense stands of ponderosa pine (*Pinus ponderosa*) and mixed conifer forest communities. These stands, in conjunction with equally high levels of woody debris on the ground and accumulated brush, pose a high fire hazard to those residences adjacent to the refuge and to the bald eagle roosting sites within it.

1.2.1 *Human Health & Safety*

A key component in meeting the underlying need is the protection and treatment of fire hazard in the wildland urban interface. The wildland urban interface refers to areas where wildland vegetation meet urban developments, or where forest fuels meet urban fuels (such as houses). These areas encompass not only the interface (areas immediately adjacent to urban development), but also the continuous slopes and fuels that lead directly to the urban developments. Reducing the fire hazard in the wildland urban interface requires the efforts of federal, state, and local agencies, Tribes, and private individuals. "The role of [most] federal agencies in the wildland urban interface includes wildland fire fighting, hazard fuels reduction, cooperative prevention and education and technical experience. Structural fire protection [during a wildfire] in the wildland urban interface is [largely] the responsibility of Tribal, state, and local governments" (USFS, 2001). Property owners share a responsibility to protect their residences and businesses and minimize fire danger by creating defensible areas around them and taking other measures to minimize the fire risks to their structures (USFS, 2001). With treatment, a wildland urban interface can provide firefighters a defensible area from which to suppress wildland fires or defend communities. In addition, a wildland urban interface that is properly thinned will be less likely to sustain a crown fire that enters or originates within it.

By reducing hazardous fuel loads, ladder fuels, and tree densities, and creating new and reinforcing defensible space, the Fish and Wildlife Service would protect the wildland urban interface, the biological resources of the refuge, and adjacent property owners by:

- minimizing the potential of high-severity ground or crown fires entering or leaving the refuge;

- reducing the potential for firebrands (embers carried by the wind in front of the wildfire) impacting the refuge. Research indicates that flying sparks and embers (firebrands) from a crown fire can ignite additional wildfires as far as 1 ¼ miles away during periods of extreme fire weather and fire behavior (McCoy et al., 2000);

- improving defensible space in the immediate areas for suppression efforts in the event of wildland fire.

The Fish and Wildlife Service recognizes the existence of four wildland/urban conditions that can be classified as a wildland urban interface (Goheen, 2002). These include the Interface Condition, Intermix Condition, Occluded Condition, and Rural Condition. Descriptions of each are as follows:

- Interface Condition – a situation where structures abut wildland fuels. There is a clear line of demarcation between the structures and the wildland fuels along roads or back fences. The development density for an interface condition is usually 3+ structures per acre;
- Intermix Condition – a situation where structures are scattered throughout a wildland area. There is no clear line of demarcation, the wildland fuels are continuous outside of and within the developed area. The development density in the intermix ranges from structures very close together to one structure per 40 acres;
- Occluded Condition – a situation, normally within a city, where structures abut an island of wildland fuels (park or open space). There is a clear line of demarcation between the structures and the wildland fuels along roads and fences. The development density for an occluded condition is usually similar to that found in the interface condition and the occluded area is usually less than 1,000 acres in size; and
- Rural Condition – a situation where the scattered small clusters of structures (ranches, farms, resorts, or summer cabins) are exposed to wildland fuels. There may be miles between these clusters.

Of the four, the Bear Valley National Wildlife Refuge wildland urban interface is characterized by the Rural Condition, where scattered small clusters of structures (ranches, farms, resorts or summer cabins) are exposed to wildland fuels. Additional information on this topic can be found in: Teie, William C. and Weatherford, Brian F., Fire in the West, The Wildland/Urban Interface Problem, A Report for the Western State Fire Managers, 2000.

1.2.2 *Forest Health*

Forest health refers to the condition in which all the components of a forest (the plants, the animals, the soil, water and nutrients, i.e. the ecosystem) are interacting (growing, feeding, reproducing, dying) in a reasonably stable, self-sustaining pattern that maintains productivity and diversity appropriate to the location and climate, and which can renew itself and recover from various disturbance events as necessary, while meeting current and future desired levels of uses, and products for people (Dahms and Geils, 1997).

A person can be in less than optimum health with a condition such as high blood pressure, obesity or many other conditions, yet can carry on a reasonably normal life. Similarly a forest ecosystem can "function" insofar as trees grow and various animals inhabit it, but the species and number of trees, their sizes and densities on the ground, and the numbers and diversity of species of animals living there may be very different from a normally functioning, healthy forest system.

It is well documented that overstocked forest stands yield trees that are stressed and in poor health because of increased competition for resources, particularly in drought years. Such conditions can increase tree susceptibility to disease and insect attack (McCambridge and Stevens, 1982, Fiddler et. al. 1989, Patterson, 1992).

1.2.3 *Existing Conditions*

Fire plays an important role in maintaining healthy ponderosa pine and mixed conifer forest communities in the northwest. Wildfires in ponderosa pine and mixed conifer communities historically consumed the grassy and other herbaceous vegetation on the forest floor, along with the dead branches, needles, fallen trees, brush, and seedlings, while leaving the mature trees largely unharmed. The result was a forest community that was rather open and park-like, with very few young trees or seedlings growing among the grassy vegetation on the forest floor. Recent studies suggest that the fire return interval for the Bear Valley Refuge was, on average, 14 years (Goheen, 1999).

Beginning around 1920, wildfires were actively suppressed in and around the refuge. The result has been ponderosa pine and mixed conifer communities that have grown up in the absence of natural, low-severity, frequent fires for many decades. Without frequent fires to kill seedlings, many have survived to form dense stands of trees crowding and interfering with each others' growth. Recent studies indicate that average tree densities within portions of the refuge were approximately 320 stems/acre, with an average basal area of 105 ft^2/acre (USFWS, 1996). High fuel loads in these overly dense stands can also be attributed to the dead woody material on the forest floor, along with masses of often intertwined dead branches still on the tree trunks. These "ladder fuels" can help flames climb from the forest floor up to the crowns of the trees. Although still alive and somewhat naturally moist, conifers' crowns can ignite and burn intensely under the right conditions. When trees are close together as they are in many parts of the refuge, fire in tree crowns can spread rapidly from tree to tree. In forest communities where the historic role of fire has been altered, and where high fire hazard exists, high-severity wildfires can occur that oftentimes result in stand replacement, where a majority of a forest stand(s) is killed outright.

The existing conditions at Bear Valley National Wildlife Refuge are characteristic of ponderosa pine and mixed conifer forest communities that have experienced over 100 years of fire suppression and been subjected to extensive timber harvest operations. Past timber harvests removed many of the largest and most fire-resistant ponderosa pine and mixed conifer species. Coupled with wildland fire suppression efforts, the result has been forest communities that are choked with dense stands of young trees, particularly white fir (*Abies concolor*). The high densities of the existing stands not only impact the health of the forest communities and impede the development of stands with large trees (old-growth), they pose a very high fire hazard. The replacement of fire-tolerant species, such as ponderosa pine, with fire-intolerant species (white fir) in the absence of natural fire regimes has aggravated the high fire hazard situation in the refuge.

The probability that a wildfire will occur (wildfire risk) on the refuge is high. Recent records indicate that between 1970 and 2001, 199 fires occurred on and in the vicinity of the refuge. Of these fires, 87 (43.7%) were human caused and 112 (56.3%) were lightning caused. This accounts for an average of approximately 7 fires per year in the area of influence surrounding or on the refuge (Goheen, 1999). In fact, the entire refuge area has physical evidence of past wildland fire activity. The reason that the refuge has a high risk of human caused fires is due to its proximity to human habitation adjacent to the refuge, proximity to the communities of Keno and Klamath Falls,

and illegal public access to the refuge. Trespasses occur by vehicle, ATV, motorcycle, and horseback.

Goheen (1999) conducted a fire probability assessment for the refuge using the computer program PROBACRE, which produces probability estimates based on the Poisson distribution. It is used to assess the long-term risk of fire. The results of the assessment are displayed by the probability of a fire exceeding area thresholds in 20 years in percent. Four area thresholds were used in the program: 50 acres, 100 acres, 500 acres, and 1,000 acres. The probabilities of a fire exceeding the 50 and 100-acre thresholds in 20 years were both 100%. The probabilities of a fire exceeding the 500 and 1,000-acre thresholds in 20 years were 84% and 66%, respectively. Hence, the probability of a large stand replacement fire (500-1,000 acres) in the short-term is very high (84% and 66% respectively).

A review of a 1998 digital orthographic photo by the Fish and Wildlife Service identified approximately 80 residences and other structures, including the Hamaker Mountain Federal Aviation Administration Radar Facility, within a one-mile radius of Bear Valley National Wildlife Refuge. The largest concentrations of development are in the northeast and southeast boundaries of the refuge. House lots are currently being sold and developed on the eastern boundary as well (Goheen, 2002). Housing development in areas adjacent to the refuge is anticipated to increase in the foreseeable future.

1.2.4 *Desired Conditions*

The Fish and Wildlife Service's objectives are to provide a margin of protection to neighboring residences from future wildfires; reduce the likelihood of catastrophic fire destroying the subroosts in the refuge; help restore and maintain the health of the forest stands; and promote a more rapid restoration of forest stand characteristics that would benefit future bald eagles nesting and roosting habitat (large trees). A reduced fire hazard condition would be one in which refuge lands have sufficiently low fuel loading to prevent large, high-severity fires from spreading into or out of the refuge, reduce the potential of firebrand ignitions, or to slow down a fires' progress sufficiently to allow firefighters an opportunity to suppress it. Land management agencies have several tools at their disposal to reduce hazardous fuel loadings, modify vegetation configurations in the wildland urban interface and other fire-prone areas, and provide defensible areas from which firefighters can manage and suppress wildfires. These include manual and mechanical fuel treatments (removal or re-arrangement of woody fuels), and prescribed fires and wildland fire use (consumption of woody fuels). It is important to note that while lower tree densities and lower fuel loadings reduce the potential of large, high-severity and/or crown fires, they do not eliminate the potential of all wildland fires.

Thinning treatments and the re-introduction of fire through prescribed fire (broadcast burning) in some areas would help maintain lower fuels and densities, and would restore the natural low-severity fire regime characteristic of healthy ponderosa pine and mixed conifer forests. Forests with a lower fuel loading and lower tree density will generally be closer to the naturally occurring forest structure and will be healthier as functioning ecosystems. In addition, hazardous fuel treatments will create forest stand conditions that will provide for additional bald eagle roosting and nesting habitat needs in the future.

Bald eagles generally prefer older, taller, and larger diameter trees for nesting and roosting (USFWS, 1996). In Bear Valley, large ponderosa pine and Douglas fir (*Pseudotsuga menziesii*) are preferred trees because of the openness of their crowns and larger limb size. Roost and nest trees are generally dominant or co-dominant in the canopy (they are the tallest or among the tallest trees in the timber stand) and typically have more diffuse crowns and a greater number of exposed branches relative to other trees in a stand (Dellasala et. al., 1987). Bald eagles in the refuge will also use other large conifer tree species, such as white fir, as roost habitat (Dellasala, 2002)

1.3 Decision to be Made

Based on the analysis documented in this EA, including public comments in response to scoping, the Manager, Klamath Basin National Wildlife Refuge Complex, will decide whether or not to authorize implementation of one or more of the management alternatives developed for this proposed project. The decision will include:

- Thinning methods to be used, such as manual and/or mechanical methods;
- Prescribed fire methods to be used, such as broadcast burning and/or slash pile burning, and if so, to what extent; and
- Mitigation and monitoring measures to employ to reduce the risk of environmental harm.

1.4 Scoping Issues and Impact Topics

On November 16, 2001, a scoping notice describing the Proposed Action and inviting the public to an open house was sent to a mailing list of 47 individuals, organizations, and media outlets. The public open house was held in Klamath Falls on November 27, 2001 to discuss the proposed use of thinning and prescribed fire treatments in the refuge. Two people signed the attendance list. The major issues and concerns that came from the open house and other public input (e.g. email, written correspondence) were evaluated and sorted. Issues determined to be general or significant were those related to the effects of the proposed action, and those not already adequately addressed by laws, regulations, and policies. Significant issues were considered in developing and evaluating the alternatives to the Proposed Action discussed in this EA.

1.4.1 *Significant Issues*

- Issue: Prescribed fires (broadcast burns) may escape or spot outside of control lines and/or discharge too much smoke, thus having the potential to impact human health and safety and bald eagle roosting sites.

1.4.2 *General Issues*

- Issue: Vehicle traffic associated with hauling out felled trees will impair the roadway and will increase fugitive dust levels.

- Issue: Some woody debris should be left on site to provide wildlife habitat and contribute to soil development and nutrient cycles.

- Issue: Threatened and Endangered species should be protected during fuel treatments.

- Issue: Habitat for wildlife should be increased.

- Issue: The Environmental Assessment should discuss the cumulative impacts from all logging activities in the region.

- Issue: White fir over 14" DBH can provide necessary roosting characteristics.

- Issue: The Environmental Assessment should disclose the number and characteristics of the residences and structures adjacent to the refuge.

- Issue: Prescribed fire would be acceptable to reduce the fire hazard in the area and to combat noxious weeds.

1.4.3 *Issues Considered but not Evaluated in this Environmental Assessment*

- Issue: The removal of trees greater than 14" Diameter Breast Height (DBH) should be prohibited since they provide essential roost habitat for the bald eagle. This issue was considered but not evaluated further because the proposed action limits thinning activities to trees less than 14" DBH.

- Issue: Thick pockets of trees (clumps) are within the historic range of variability and should be preserved. This issue was considered but not evaluated further because the proposed action calls for preserving a minimum of 15% of the treated areas in clumps.

- Issue: Following thinning treatments, sugar pine and ponderosa pine should be aggressively planted in some areas since their numbers are reduced and pine regeneration appears to be inadequate. The Fish and Wildlife Service will allow for natural regeneration to occur following thinning and prescribed fire treatments, however, any areas where pine regeneration appears to be inadequate would be identified and appropriate future management actions would be undertaken, including the possibility of tree plantings. The Fish and Wildlife Service recognizes the apparent inconsistency in employing fire hazard reduction (thinning and prescribed fire) to remove young trees in the refuge, only to be potentially followed up at a later date with tree plantings. The reason for undetaking tree plantings in the future would be to restore and promote those tree species that best provide for successful bald eagle nesting and roosting.

- Issue: Fuel breaks should not be a component of the proposed action since numerous studies demonstrate that they do not contain wildfires. This issue was considered but not evaluated further because the proposed action does not include the construction of fuel breaks.

- Issue: Wildlife conservation is the single mission for the Fish and Wildlife Service, and reducing the fire hazard for adjacent structures and residences is not consistent with that mission. Fire hazard reduction efforts by the Fish and Wildlife Service would protect existing nesting and roosting habitat for the bald eagle (wildlife conservation), promote the development of future bald eagle nesting and roosting sites (wildlife conservation), and protect private property in the wildland urban interface. In the Department of Interior and Related Agencies Appropriation Act, the U.S. Congress appropriated funds and directed federal agencies that manage public lands, including the U.S. Fish and Wildlife Service, to take measures to reduce the fire hazard in the wildland urban interface. Reducing the fire hazard for adjacent structures and residences in turn reduces the potential for human-caused wildfires from entering the refuge and impacting bald eagle nesting and roosting sites.

- Issue: A Comprehensive Conservation Plan, consistent with the National Wildlife Refuge Improvement Act, must be prepared before new or additional logging activities are undertaken. The Klamath Basin National Wildlife Refuge Complex is slated to develop its Comprehensive Conservation Plan in fiscal year 2007. Until such a time when the plan is completed, management activities within the 6 refuges of the complex may be undertaken, including habitat management, to fulfill refuge purposes.

- Issue: There are only a few residences and structures surrounding the Bear Valley Refuge in the northeastern corner, yet the Fish and Wildlife Service proposes to treat the entirety of the area; the scope of this action is too large and is a misapplication of refuge funds. In the Department of Interior and Related Agencies Appropriation Act, the U.S. Congress appropriated funds and directed federal agencies that manage public lands, including the U.S. Fish and Wildlife Service, to take measures to reduce the fire hazard in the wildland urban interface. There are approximately 80 residences and other structures, including the Hamaker Mountain Federal Aviation Administration Radar Facility, within a one-mile radius of Bear Valley National Wildlife Refuge. The largest concentrations of development are in the northeast and southeast boundaries of the refuge. House lots are currently being sold and developed on the eastern boundary as well. The Radar Facility is located approximately ¾ mile to the west of the refuge boundary.

1.4.4 *Impact Topics Evaluated in this Environmental Assessment*

Impact topics are derived from issues raised during internal and external scoping. Not every conceivable impact of a proposed action is substantive enough to warrant analysis. The following topics, however, do merit consideration in this environmental assessment:

Soils: Soils can potentially be adversely affected by fires as well as by thinning activities; therefore, impacts to soils are analyzed in this assessment.

Water Resources: Both fires and thinning activities can affect water resources by exposing soils or impacting riparian areas, which lead to erosion during storm events and subsequent suspended solids and turbidity in downstream surface waters. Therefore, impacts to water resources are analyzed in this assessment.

Vegetation: The protection and management of forest communities for the bald eagle is the key mission for the Bear Valley National Wildlife Refuge. Since fire hazard reduction involves changes to the current vegetation structure and fire regime in the forest communities, this assessment considers the impacts on vegetation.

Wildlife: There are resident populations of various species of reptiles, amphibians, birds, mammals, and invertebrates on the refuge, including the federally protected bald eagle; therefore, impacts on wildlife are evaluated in this assessment

Noise: Thinning and prescribed fire activities can all involve the use of noise-generating mechanical tools and devices with engines, such as chain saws and trucks. Since sensitive receptors (bald eagles) are located on the refuge, noise impacts are evaluated in this assessment.

Air Quality: The Federal 1970 Clean Air Act stipulates that Federal agencies have an affirmative responsibility to protect air quality from adverse air pollution impacts. All types of fires generate smoke and particulate matter, which can impact air quality within the refuge and surrounding region to some extent; therefore impacts to air quality are evaluated in this assessment.

Transportation: Thinning activities may include the use of large trucks to remove felled trees, and these operations could impact existing access roads into the refuge; therefore, this topic is evaluated in this assessment.

Socioeconomics: NEPA requires an analysis of impacts to the "human environment" which includes economic, social and demographic elements in the affected area. Since commercial thinning may result with the implementation of the action alternatives, this impact topic is included for further analysis in this assessment.

Human Health and Safety: Fires can be extremely hazardous, even life-threatening, to humans, and current federal fire management policies emphasize that firefighter and public safety is the first priority. Since prescribed fire is a component of the proposed action, impacts to human health and safety are addressed in this assessment.

Cultural Resources: Section 106 of the National Historic Preservation Act of 1966 provides the framework for Federal review and protection of cultural resources, and ensures that they are considered during Federal project planning and execution. Cultural resources can be affected both by fire itself and thinning activities, thus potential impacts to cultural resources are addressed in this assessment.

1.4.5 *Impact Topics Considered but not Evaluated in this Environmental Assessment*

NEPA and the CEQ Regulations direct agencies to "avoid useless bulk...and concentrate effort and attention on important issues" (40 CFR 1502.15). Certain impact topics that are sometimes addressed in NEPA documents on other kinds of proposed actions or projects have been judged to not be substantively affected by any of the alternatives considered in this assessment. These

topics are listed and briefly described below, and the rationale provided for considering them, but dropping them from further analysis.

Public Access (Recreation): Public access is a minor issue since the Bear Valley National Wildlife Refuge is closed to the public except during the Oregon deer-hunting season. It is estimated that Bear Valley receives between 100-250 hunter use visits annually. Hunting use is limited to walk-in use only.

Land Use Plans/Policies/Controls: Selection of any of the alternatives would not set a precedent for future actions with significant effects on land use plans, policies or controls.

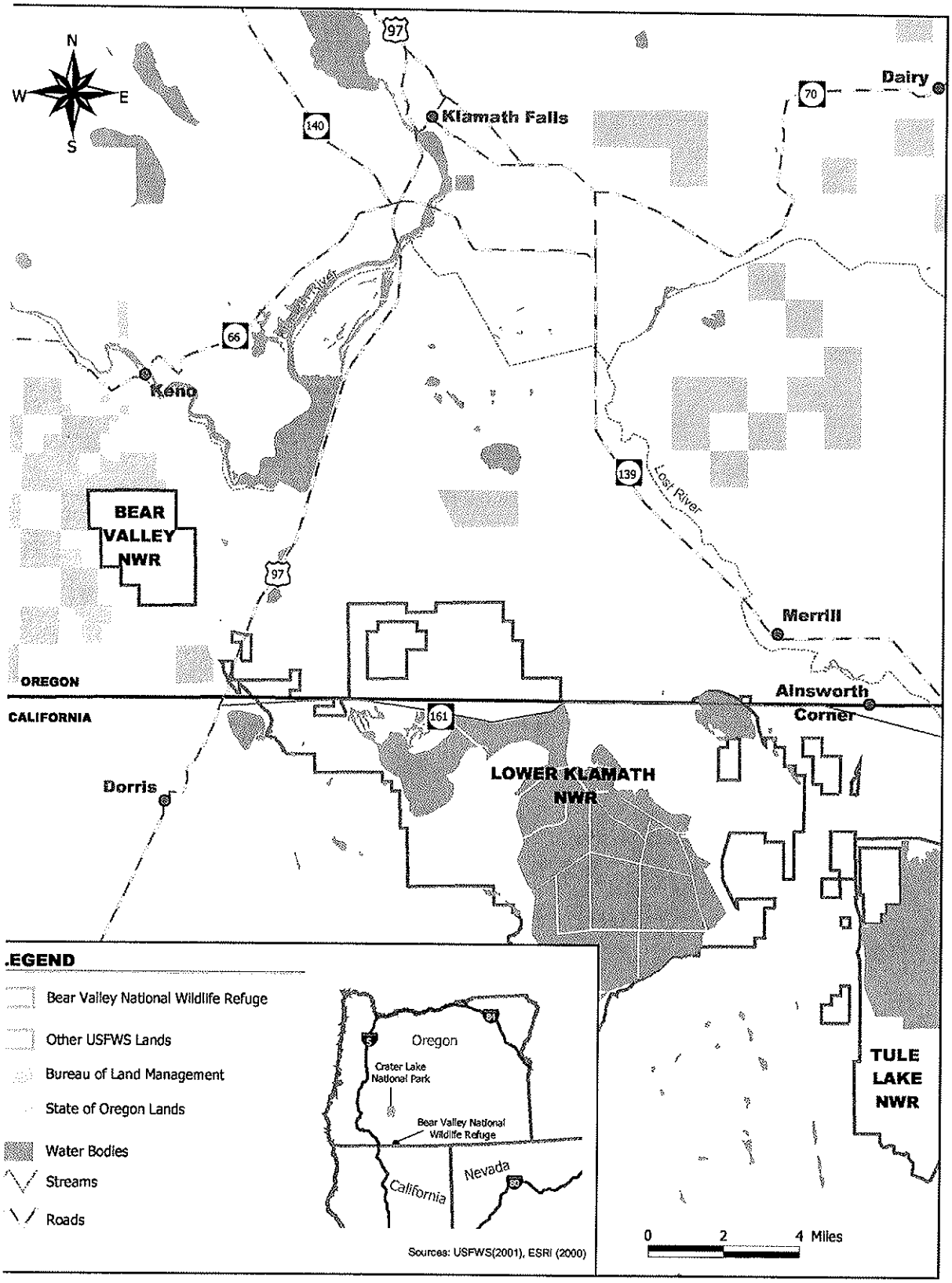

Figure 1-1
Bear Valley National Wildlife Refuge Vicinity

Chapter 2 - Alternatives

This Chapter describes the range of alternatives, including the Proposed Action and No Action Alternatives, formulated to address the purpose of and need for the proposed project. These alternatives were developed through evaluation of the comments provided by individuals, organizations, governmental agencies, and the interdisciplinary team.

2.1 Alternatives Considered But Not Analyzed Further in This EA

2.1.1 *Fire Hazard Reduction with Wildland Fire Use*

Wildland fire use involves the management of fires ignited by natural means (usually lightning) that are permitted to burn under specific environmental conditions for natural resource benefits. This alternative was considered but not analyzed further in this EA because the 4,200 acres of the refuge is too small to ensure fire containment within refuge boundaries, and valuable natural resources would be at risk. Refuge staff concluded that the potential risks to human health and safety and natural resources (bald eagle roosting sites) under this alternative outweigh any potential resource benefits that would be obtained from including wildland fire use.

2.1.2 *Fire Hazard Reduction with Prescribed Fire Only*

This alternative was considered but not analyzed further in this EA because the existing conditions on the refuge, over-crowded forest stands and high levels of surface and ladder fuels, would make it impossible for Fish and Wildlife Service fire management personnel to ensure, with any degree of certainty, fire containment. Without employing thinning treatments in conjunction with prescribed fire, the probability of a prescribed fire burning out-of-prescription under the current fire hazard conditions is great enough that refuge staff concluded that the potential risks to human health and safety and natural resources (bald eagle roosting sites) under this alternative outweigh any potential resource benefits that would be obtained.

2.2 Alternatives Considered and Analyzed in This EA

2.2.1 *Alternative 1 (No Action Alternative) – Suppression of All Wildfires and No Fire Hazard Reduction*

Under this alternative, the Fish and Wildlife Service would continue current management practices in the remaining 2,400 acres of that were not originally slated for fire hazard reduction efforts in 1996. Management practices for the remaining 2,400 acres do not include any fire hazard reduction efforts (thinning, prescribed fire, wildland fire use). All wildfires would be actively suppressed.

2.2.2 *Alternative 2 (Proposed Action) – Implement Thinning and Prescribed Fire Treatments to Reduce Fire Hazard*

Under this alternative, the Fish and Wildlife Service proposes to reduce fuels on the remaining 2,400 acres in the Bear Valley Refuge that were not originally slated for fire hazard reduction efforts in 1996. The Refuge would accomplish fire hazard reduction with manual and mechanical fuel treatments, as well as with prescribed fire.

Manual and mechanical fuel treatments would be employed on 2,400 acres slated for fire hazard reduction efforts (see Figure 2-1). These areas, which include the wildland urban interface, would be thinned by the refuge staff and/or through commercial contracts. Forest stands would be thinned on average to 70-170 trees per acre, reflective of pre-European settlement ponderosa pine and mixed conifer forest communities. Treated stands would also result in an average 40-60 basal area per acre, and an average crown spacing of 20 feet. Treated areas will retain some snags (dead trees) and large downed trees as these are important habitat for a variety of wildlife species. The Fish and Wildlife Service proposes to restore the tree stands to an older, larger forest composition by thinning smaller and less healthy trees and favoring trees in the upper crown classes (thinning from below). No trees over 14" DBH would be thinned as these can provide essential roost habitat for the bald eagle. In recognition of the forest health and wildlife benefits of forest stand clumps, as well as visual objectives, thinning would be done so as to provide a diverse, non-uniform appearance, with a minimum of 15% of treated areas left as thickets. Thinned trees and ground fuels would be removed from the treatment units, chipped and scattered on site, or stacked in piles (slash piles) and burned.

Thinning operations would be concentrated between August 1 and November 15 to avoid any potential impacts to nesting and/or roosting bald eagles; however, thinning efforts could be employed on some stands during the spring and summer months where no adverse impacts are expected to occur to nesting eagles, and only after consultation with and clearance from Fish and Wildlife Service endangered species biologists.

Prescribed fire would be employed in treated areas to remove ground fuels and slash from thinning operations, and later, to restore the low-severity, high frequency fire regime of the ponderosa pine forest communities (fire return interval of approximately 14 years). In addition, prescribed fire may be used in other areas prior to thinning if on-site tree densities are low enough to reduce the potential for an escaped wildfire or an out-of-prescription burn.

In its continuing effort to improve habitat management for the bald eagle on the refuge, the Fish and Wildlife Service would employ adaptive management to this project by incorporating and acting upon information obtained through monitoring efforts of fire hazard reduction efforts in the 1,600 acres originally slated for treatment in 1996.

2.2.3 Alternative 3 – *Implement Only Thinning Treatments to Reduce Fire Hazard*

This alternative responds to the public's concern regarding the possible escape of prescribed fire and any associated human health & safety issues associated with such an event. Under this alternative, manual and mechanical fuel treatments would be similar to those described in Alternative 2.

Prescribed fire would be prohibited on the remaining 2,400 acres in the Bear Valley Refuge that were not originally slated for fire hazard reduction efforts in 1996.

2.3 Impact Definitions

Table 2-1 depicts the impact definitions used in this Environmental Assessment. Significant impact thresholds for the various impact topics were determined in light of compliance with existing state and federal laws, and compliance with existing Bear Valley National Wildlife Refuge planning documents.

Table 2-1 Impact Definitions

	"Minor" Impact	**"Major" or "Significant" Impact**
Impact Topics		
Soils	Minor damage to or loss of the litter/humus layers that causes minor localized increases in soil loss from erosion; fire severe enough to cause minor harm to soil community; minor, temporary surface sterilization of soils that does not cause long term loss of soil productivity that would alter or destroy vegetation community	Damage to or loss of the litter/ humus layers that would increase soil loss from erosion on a substantial portion of the burn area; fire severe enough to damage soil community; substantial surface sterilization of soils that may cause long term loss of soil productivity and that may alter or destroy a portion of the vegetation community
Water Resources	Minor damage to or loss of the litter/humus layers that increases sedimentation on no more than 0.1% of a subwatershed; localized and indirect riparian impact that does not substantively increase stream temperatures or affect stream habitats	Damage to or loss of the litter/ humus layers that increases sedimentation on greater than 0.1% of a subwatershed; localized and indirect riparian impact that may substantively increase stream temperatures or affect stream habitats
Vegetation	Thinning of small understory trees; transition from fire-intolerant plant species to fire-tolerant plant species	Adverse impacts (taking, permanent displacement, loss of critical habitat) to Threatened, Endangered, or Sensitive species or their protected habitats (federal and state listed); thinning of large diameter or old growth trees
Wildlife	Temporary displacement of localized individuals or groups of animals; isolated mortality of individuals of species not afforded special protection by state and/or federal law	Adverse impacts (taking, permanent displacement, loss of critical habitat) to Threatened, Endangered, or Sensitive species or their protected habitats (federal and state listed); mortality of species that jeopardize the resident population
Air Quality	Minimal to negligible air emissions and temporary smoke accumulation; temporary and limited smoke exposure to sensitive resources	Violation of state and federal air quality standards; prolonged smoke exposure to sensitive receptors

Noise	<65 dBA at sensitive receptors; temporary noise levels <90 dBA	>65 dBA noise level at sensitive receptors (schools, nursing homes, etc.); continued exposure to noise levels > 90 dBA for workers and/or the general public
Transportation	An increase in traffic that is not predicted to upset the normal flow of traffic; the need for minor road repair as a result of the action; the generation of traffic levels that does not require the expansion of existing roadways or facilities	An increase in traffic that is predicted to upset the normal flow of traffic; the need for major road repair as a result of the action; the generation of traffic levels requiring the expansion of existing roadways or facilities
Socioeconomics	Minimal to no short or long-term economic impact on local or regional economy (>2%); proportionate impact on poor or minority communities	A change in local or regional economy greater than 2%; disproportionately high and adverse impact on poor or minority communities
Human Health & Safety	Minor injuries to any worker; limited exposure to hazardous compounds or smoke particulates at concentrations below health-based levels	Serious injury to any worker or member of the public; exposure to hazardous compounds or smoke particulates at concentrations above health-based levels.
Cultural Resources	Temporary, non-adverse effects to registered heritage sites, eligible heritage sites, sites with an undetermined eligibility, and traditional cultural properties	Temporary or long-term adverse impacts to registered heritage sites, eligible heritage sites, sites with an undetermined eligibility, and traditional cultural properties

2.4 Mitigation Measures and Monitoring

Klamath Basin National Wildlife Refuge Complex staff would collect information on fuel reduction efforts, vegetative resources, and other variables after a fire (wildfire or prescribed fire). During fire events (prescribed fire), data would be collected regarding the current fire conditions consistent with the variables identified in a prescribed burn plan, such as fuel and vegetation type, anticipated fire behavior and fire spread, current and forecasted weather, smoke volume and dispersal, etc. In addition, the Fish and Wildlife Service would continue to conduct fly-out surveys and nest surveys on the refuge as part of its monitoring efforts on behalf of the bald eagle.

Mitigation measures are prescribed to prevent and/or mitigate adverse environmental impacts that may occur from fire hazard reduction activities. Mitigation measures are common to all alternatives.

2.4.1 *Fire Management Activities*

- No handlines exposing mineral soil will be allowed through cultural sites, and all handlines will be rehabilitated. Erosion control methods will be used on slopes exceeding 30% where handline construction takes place;

- All sites where improvements are made or obstructions removed will be rehabilitated to pre-fire conditions, to the extent practicable;
- Whenever consistent with safe, effective suppression techniques, the use of natural barriers will be used as extensively as possible;

2.4.2 *Soil, Water Resources, and Vegetation*

- Stream crossings will be limited to set and existing locations;
- Except for spot maintenance to remove obstructions, no improvements will be made to intermittent waterways or clearings in forested areas;
- Fire lines will be located outside of highly erosive areas, steep slopes, intermittent streams, riparian areas, and other sensitive areas;
- Fire retardants and foams will not be used in riparian areas;
- Mechanical thinning (large equipment) will be prohibited within 100 feet of intermittent streams and steep slopes (>35% slope);
- Mechanical equipment will be restricted in operations to dry or frozen ground (<20% soil moisture);

2.4.3 *Wildlife*

- Thinning and prescribed fire operations will be concentrated between August 1 and November 15 to avoid any potential impacts to nesting and/or roosting bald eagles;
- During the peak roosting period (November 15-April 1), Fish and Wildlife Service personnel may enter the refuge to conduct treatment unit reconnaissance and layout, however, this activity would only occur in the refuge during the daylight hours when the eagles are not present (approximately between 9:00 am and 3:00 pm);
- During the bald eagle nesting season (April 1-August 1), prescribed fire will be allowed on some stands in the spring months and thinning efforts will be allowed on some stands during the spring and summer months after consultation with and clearance from Fish and Wildlife Service endangered species biologists, and only after meeting the following mitigation measures:
    - Work would be prohibited within ½ mile from active nests;
    - An observer may be stationed on Pearson Butte to watch active nests for any disturbance caused by smoke or noise from thinning and prescribed fire activities;
    - Work would be immediately curtailed in the event that disturbance was observed; and
    - Prescribed fire units would be limited to 10 acres in size so that burning could be curtailed quickly in the event of a disturbance. Backing fires would be used when possible to limit smoke production. All burns would be aggressively mopped-up. Burn prescriptions would be written to minimize the potential for high-intensity fire and to avoid severe drought and/or high wind conditions.

2.4.4 *Air Quality and Noise*

- Operation of large vehicles associated with thinning efforts will be restricted to daylight hours, generally 8:00 am – 5:00 pm

- To reduce fugitive dust, access roads will be wetted each day by either the Fish and Wildlife Service or the contractor when hauling operations are being conducted in association with thinning activities;

2.4.5 *Transportation*

- Vehicle traffic associated with thinning activities will access and exit the refuge on both the north and south access roads, FWS roads # 10 and 20, respectively;
- Following the conclusion of thinning activities, road improvements will be made, as necessary, to repair damage to the access roads resulting from vehicle use associated with thinning operations;
- Vehicles associated with thinning operations will be restricted to a 25-mph speed limit on refuge access roads;

2.4.6 *Cultural Resources*

- Prior to all thinning and prescribed fire activities, cultural resources in treatments areas will be identified and avoided;
- If unrecorded cultural resources are discovered during thinning and prescribed fire activities, all work in the immediate vicinity of the cultural resource will stop until a Fish and Wildlife Service Archeologist surveys and records the location.

2.5 COMPARISON OF ALTERNATIVES

Table 2-2 briefly summarizes the environmental effects of the various alternatives. It provides a quick comparison of how well the alternatives respond to the project need, objectives and impact topics. Chapter 3 discusses the environmental consequences of the proposed alternatives in detail.

Table 2-2 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Impact Topics

	Alternative 1 - No Action Alternative (Current Management Actions)	Alternative 2 - Proposed Action (Thinning and Prescribed Fire Treatments)	Alternative 3 – Thinning Treatments Only
Project Need			
Fire hazard reduction	No, hazardous fuels would continue to increase This alternative provides the **least hazardous fuels reduction**	Yes, hazardous fuels reduction over time on ~2,400 acres This alternative provides the **greatest hazardous fuels reduction**	Yes, hazardous fuels reduction over time on ~2,400 acres This alternative provides **less hazardous fuels reduction** on ~2,400 acres than does the Proposed Action
Restore forest stands	No, forest stands would not be restored on ~2,400 acres of the refuge This alternative provides the **least amount of forest stand restoration**	Yes, hazardous fuel treatments would help restore forest stands on ~2,400 acres of the refuge This alternative provides the **greatest amount of forest stand restoration**	Yes, hazardous fuel treatments would help restore forest stands on ~2,400 acres of the refuge This alternative provides **less forest stand restoration** than does the Proposed Action
Project Objectives			
Protect neighboring residences from future wildfires	Besides wildland fire suppression, no additional protection to neighboring residences would be provided This alternative provides the **least degree of protection** to neighboring residences from future wildfires	Yes, hazardous fuel treatments would help protect neighboring residences from future wildfires This alternative provides the **greatest degree of protection** to neighboring residences from future wildfires	Yes, hazardous fuel treatments would help protect neighboring residences from future wildfires This alternative provides **less protection** to neighboring residences from future wildfire than does the Proposed Action
Reduce the likelihood of catastrophic fire destroying bald eagle roosting sites	No, there would not be any reduction in the likelihood of catastrophic fire destroying bald eagle roosting sites This alternative **does not reduce the likelihood** of catastrophic fire destroying bald eagles roosting sites	Yes, hazardous fuel treatments would reduce the likelihood of catastrophic fire destroying bald eagle roosting sites This alternative **best reduces the likelihood** of catastrophic fire destroying bald eagle roosting sites	Yes, hazardous fuel treatments would reduce the likelihood of catastrophic fire destroying bald eagle roosting sites This alternative **marginally reduces the likelihood** of catastrophic fire destroying bald eagle roosting sites

Table 2-2 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Impact Topics

	Alternative 1 - No Action Alternative (Current Management Actions)	Alternative 2 - Proposed Action (Thinning and Prescribed Fire Treatments)	Alternative 3 – Thinning Treatments Only
Restore and maintain the health of forest stands	No, forest health in ponderosa pine and mixed conifer stands would not be restored and maintained This alternative **does not restore and maintain forest stand health**	Yes, hazardous fuel treatments would help restore and maintain the health of forest stands on ~2,400 acres of the refuge This alternative provides the **greatest degree of restoration and maintenance of forest stand health**	Yes, hazardous fuel treatments would help restore and maintain the health of forest stands on ~2,400 acres of the refuge This alternative provides **less restoration and maintenance of forest stand health** than does the Proposed Action
Promote future bald eagles nesting and roosting habitat	No, future bald eagle nesting and roosting habitat would not be promoted This alternative **does not promote future bald eagle nesting and roosting habitat**	Yes, future bald eagle nesting and roosting habitat would be promoted on ~2,400 acres of the refuge This alternative **best promotes the development of future bald eagle nesting and roosting habitat**	Yes, future bald eagle nesting and roosting habitat would be promoted on ~2,400 acres of the refuge This alternative promotes **less development of future bald eagle nesting and roosting habitat** than does the Proposed Action
Significant Issues			
Potential escape of prescribed fire	There would be no potential for escape of prescribed fire since there would be no prescribed fires	This alternative allows for prescribed fire, however, potential for escape would be minimal in light of mitigation measures and adherence to guidelines and procedures for ignition of prescribed fires	There would be no potential for escape of prescribed fire since there would be no prescribed fires
Impact Topics			
Soils	No immediate soil impacts; potential for soil erosion in the event of a large, high-severity wildfire	Minor short-term soil erosion and compaction impacts resulting from thinning and prescribed fire activities; soil buildup and enrichment from prescribed fires	Minor short-term soil erosion and compaction impacts resulting from thinning

Table 2-2 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Impact Topics

	Alternative 1 - No Action Alternative (Current Management Actions)	Alternative 2 - Proposed Action (Thinning and Prescribed Fire Treatments)	Alternative 3 – Thinning Treatments Only
Impact Topics			
Water Resources	No immediate water resource impacts; potential for flash flooding events that degrade stream channels after large, high-severity wildfires	Minor indirect impacts to water resources from thinning, prescribed fires, and construction of fire lines	Minor indirect impacts to water resources from thinning
Vegetation	No reduction of hazardous fuels on ~2,400 acres of the refuge; no restoration of forest health in ponderosa pine and mixed conifer stands; fire-intolerant (white fir), shade-tolerant plant species continue to out-compete fire-tolerant, shade-intolerant plant species; increased risk of bark beetle infestations and large, high-severity wildfires destroying forest stands in the refuge; habitat and plant diversity continue to decline	Reduction of hazardous fuels on ~2,400 acres of the refuge; forest health in ponderosa pine and mixed conifer stands improve with reduction in tree densities, more open canopies, and restoration of natural fire regimes; plant habitat and diversity increase over time; promotion of fire-tolerant, shade-intolerant plant species, as well as the development of large diameter trees (old-growth); potential for bark beetle infestations reduced with greater tree vigor; forest stands better able to withstand high-severity wildfires	Similar to the Proposed Action, however plant habitat and diversity marginally improved with thinning as a fire surrogate; ponderosa pine and mixed conifer forest health impacted in the absence of prescribed fire and natural fire regimes (high frequency, low-severity fires)
Wildlife	No immediate wildlife impacts; continued high potential for a large, high-severity wildfire destroying bald eagle nesting and roosting sites in the refuge (66% chance for a 1,000-acre or greater wildfire in the next 20 years)	Hazardous fuels reduction would temporarily displace some wildlife species and result in isolated mortality of individuals; very minor to no impact on bald eagles in the short-term; in the long-term, the protection of existing and the promotion of future bald eagle nesting and roosting sites in the refuge; wildlife habitat and diversity benefited as forest communities transition back to pre-European settlement conditions	Similar to the Proposed Action, however, wildlife habitat and diversity continue to decrease in the absence of prescribed fire and the natural fire regimes in ponderosa pine and mixed conifer stands
Air Quality	No immediate air quality impacts; air quality impacts from future wildfires would be greater in the absence of hazardous fuels reduction	Minor and short-term air quality impacts from prescribed fires, mechanical equipment emissions, and fugitive dust	Minor and short-term air quality impacts from mechanical equipment emissions and fugitive dust

Table 2-2 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Impact Topics

Impact Topics	Alternative 1 - No Action Alternative (Current Management Actions)	Alternative 2 - Proposed Action (Thinning and Prescribed Fire Treatments)	Alternative 3 – Thinning Treatments Only
Noise	No noise impacts	Minor noise impacts during thinning activities and transportation of felled trees off-site; minor to no impact on nesting bald eagles	Similar to the Proposed Action
Transportation	No transportation-related impacts	Minor impact to local traffic and existing access roads to the refuge with the use of large trucks to haul out felled trees	Similar to the Proposed Action
Socio-economics	No impacts to minority or low-income populations; no impact on local and regional economies; no increase in revenue sharing with the County	No impacts to minority or low-income populations; very minor impact on local and regional economies; very minor to no increase in revenue sharing with the County	Similar to the Proposed Action
Human Health & Safety	Short and long-term safety risk to adjacent residences from high fire hazard on the refuge; continued high-potential for a large, high-severity wildfire (66% chance for a 1,000-acre or greater wildfire in the next 20 years)	Human health and safety improved with reduction in fire hazard following thinning and prescribed fire treatments; increased potential for isolated injuries to crews from thinning activities; minor exposure to smoke by workers and the public during prescribed fires	Similar to the Proposed Action except that workers and the public would not be exposed to smoke from prescribed fires; human health and safety improved with reduction in fire hazard following thinning efforts, however, the improvement would be less than that obtained under the Proposed Action
Cultural Resources	No immediate impacts to cultural resources; potential long-term risk to cultural resources from increased fire hazard and large, high-severity wildfires	Similar to the No Action Alternative, however, there would be the potential for impacting unrecorded cultural resources	Similar to the Proposed Action

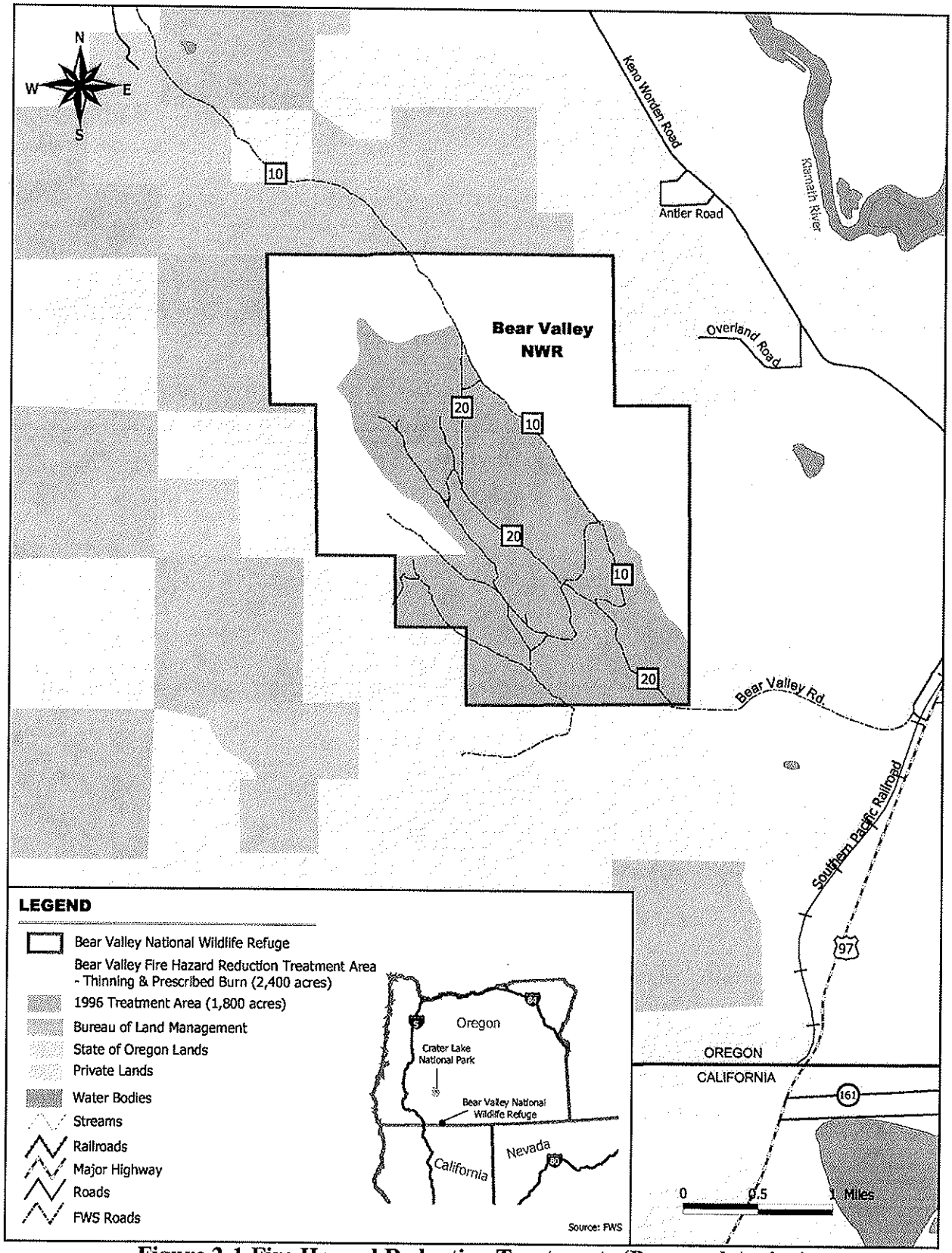

Figure 2-1 Fire Hazard Reduction Treatments (Proposed Action)

Chapter 3 – Environmental Analysis

This chapter summarizes the existing environmental conditions and the probable environmental consequences (effects) of implementing the action and No-Action alternatives. This chapter also provides the scientific and analytical basis for comparing the alternatives. The probable environmental effects are quantified where possible; where not possible, qualitative descriptions are provided.

3.1 Soils

3.1.1 *Affected Environment*

In the Bear Valley, the principal soil type is Woodcock stony loam, which is found on 5-40% slopes, and which is derived from weathered andesite, other felsites, basalt, and minor amounts of pyroclastic rocks and ash. It is present on areas of higher precipitation (18-25") and lower temperatures, and supports forest tree species. Less prevalent soil types that can be found on drier sites include Lobert loam, Calimus loam, Lorella very stony loam, Royst stony loam, and Dehlinger very stony loam. These soils support western juniper (*Juniperus occidentalis*), woody shrubs, and grasses (USFWS, 1978). Loams and stony loams with an ash component in the area are generally susceptible to compaction and have moderate to moderately-high permeability (Weinheimer, 2002).

3.1.2 *Environmental Consequences*

Soil impacts were qualitatively assessed using soil characteristics, literature reviews, and mitigation measures.

3.1.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any actions that would directly impact soils. In the absence of fire hazard reduction treatments, however, the likelihood of a high-severity fire increases. Such an event could be detrimental to soils as nutrients are volatized and the organic layer of the soil could be consumed and soil layers could become water repellant. In addition, the potential for erosion would increase following a high-severity fire.

3.1.2.2 Alternative 2 – Proposed Action

Proposed activities with the potential to impact soils include building fire lines, thinning, and prescribed burning.

The construction of a fire line involves digging a 15-inch wide line down to mineral soil and raking a 15-foot buffer along each side of the fire line to clear out vegetative debris on the ground. Fire line construction would result in soil disturbance and could lead to increased erosion, especially in steeply sloped areas. To avoid potential impacts, fire lines would be located

outside of highly erosive areas, steep slopes, intermittent streams, and riparian and other sensitive areas. Following prescribed fire or fire suppression activities, fire lines would be rehabilitated.

Thinning activities that involve heavy machinery would result in compaction of soils in localized areas of ingress and egress. The degree of soil compaction depends on the number of passes over a particular area as well as the type of vehicle. Slash generated from mechanical thinning activities would be spread on the pathways of the equipment to minimize soil compaction. In addition, mechanical equipment (large vehicles) would not be employed in highly sloped portions of the treatment areas (> 35% slope), would be restricted in operations to dry or frozen ground (<20% soil moisture), and would not be employed within 100 feet of surface water resources.

Prescribed fire would release nutrients into the soil and the fertilization effects of ash would provide an important source of nutrition for vegetation in the area. In addition to increasing nitrification of the soils and increasing minerals and salt amounts in the soil, the ash and charcoal residue resulting from incomplete combustion would aid in soil buildup and soil enrichment by being added as organic matter to the soil profile. The added material works in combination with dead and dying root systems to make the soil more porous, better able to retain water, and less compact while increasing needed sites and surface areas for essential microorganisms, mycorrhiza, and roots (Vogl, 1979; Wright and Bailey, 1980).

If a prescribed fire exceeded a burn prescription and burned "hot", resulting in areas of high-burn severity, the organic layer of the soil could be consumed and soil layers could become water repellant. Fire management personnel would contain and/or suppress out-of-prescription fires, minimizing the potential for and effects of any high-burn severity prescribed fires.

3.1.2.3 Alternative 3

General soil impacts would be similar to those described under Alternative 2, except the benefits accruing to soils from prescribed fire would not occur.

3.2 Water Resources

3.2.1 *Affected Environment*

Surface water resources on the Bear Valley National Wildlife Refuge are limited to a few intermittent streams that carry water during high rain events and following snow melt in the spring. There are no wetlands or floodplains in the refuge.

3.2.2 *Environmental Consequences*

Water resource impacts were qualitatively assessed using presence/absence and mitigation measures.

3.2.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any actions that would directly impact water resources. In the absence of fire hazard reduction treatments, however, the likelihood of a high-severity fire increases. In the aftermath of a large, high-severity wildfire, the refuge could experience flash flooding events that degrade the stream channels.

3.2.2.2 Alternative 2 – Proposed Action

Proposed activities with the potential to impact water resources include building fire lines, thinning, and prescribed burning; however, in light of the mitigation measures employed during fire management activities (e.g. no fire line construction in intermittent streams, wetlands or adjacent to natural springs; no mechanical thinning treatments (large vehicles) within 100-feet of surface water resources), there would be minor indirect impacts on surface water resources on the refuge.

In addition, the use of prescribed fire would temporarily reduce vegetation and expose soils to a greater potential of erosion from wind and rain. This effect would be temporary as burned areas become re-vegetated with grasses and shrubs.

3.2.2.3 Alternative 3

General water resources impacts under Alternative 3 would be similar to those described under Alternative 2.

3.3 VEGETATION

3.3.1 *Affected Environment*

There are three different plant communities in the refuge, occupying sites that differ in elevation, slope, and aspect, and therefore moisture and temperature. Drier sites with 8-10" annual precipitation (usually at lower elevations or on south or southwest-facing slopes) support a western juniper, bitterbrush (*Purshia tridentata*), bunchgrass community. This community gradually merges with a ponderosa pine dominated community at 4600', where annual precipitation averages 14.3". In some areas, this community is intermixed with shrubs, such as bitterbrush and sagebrush (*artemisia*), and bunchgrass. At higher elevations and north-facing slopes, the ponderosa pine community merges with other conifers such as Douglas fir, incense cedar (*Calocedrus decurrens*), sugar pine (*Pinus lambertiana*), and white fir (USFWS, 1978).

Vegetation conditions at Bear Valley National Wildlife Refuge are characteristic of ponderosa pine and mixed conifer forest communities that have experienced over 80 years of fire suppression and been subjected to extensive timber harvest operations. Past timber harvests removed many of the largest and most fire-resistant ponderosa pine and mixed conifer species. Coupled with wildland fire suppression efforts, the result has been even-aged forest stands that are choked with dense stands of young trees, particularly white fir (*Abies concolor*). Generally, forest stands in the refuge today contain higher numbers of fire-intolerant, shade-tolerant tree species.

Overly dense forest stands not only pose a high fire hazard, they can lead to outbreaks of a group of insects called bark beetles (Family *Scolytidae*). These are among the most destructive insects of North American conifer forests. Many species reach epidemic proportions in forests that are either overmature, overstocked or stressed by drought or wildfire. Bark beetles attack the cambium layer of trees where they construct egg and larval galleries. Trees that are successfully attacked are killed. In addition, most bark beetles introduce blue stain fungi into infested trees. These fungi enter the woody tissue and hasten the death of infested trees. Some bark beetles are capable of attacking trees weakened by fire and the brood emerging from the fire-damaged trees can attack and kill trees suffering slight fire damage or no damage (USFS, 2000). Specific bark beetles of importance in the Bear Valley Refuge include the mountain pine beetle (*Dendroctonus ponderosae*), western pine beetle (*Dendroctonus brevicomis*), and fir engraver (*Scolytus ventralis*). The refuge has had considerable evidence of white fir mortality as a result of attacks by the fire engraver (USFS, 1996).

The refuge also has had significant levels of dwarf mistletoe in Douglas fir, and to a lesser extent, ponderosa pine and white fir. Mistletoes are generally host specific, and their occurrence and intensity are independent of site quality or tree stocking levels. A few areas displayed symptoms associated with Armillaria root disease, caused by the fungus *Armillaria ostoyae*. As with bark beetles, the root disease is influenced by tree vigor. White fir and Douglas fir are the most susceptible tree species in the refuge (USFS, 1996).

Once fire hazard reduction treatments improve overall forest health, however, some natural mortality would be acceptable in the refuge from insect and disease attacks. Disease and insects are primary sources of discontinuities in forest stand structure and are important natural sources of landscape diversity (Lundquist, 1993). Dellsalla et al. (1997) suggested that small insect and disease outbreaks may enhance bald eagle roosting habitat at Bear Valley through creation of snags and exposing understories to increased light levels.

Bear Valley contains several populations of noxious weeds, however, infestation is considered small to moderate. The highest priority noxious weed is the yellow star thistle (*Centaurea solstitialis*), which is located in areas adjacent to the southern access road (Road #20, or Bear Valley Road). The distribution of bull thistle (*Cirsium vulgare*) is more widespread than the yellow star thistle, however, its numbers on the refuge are small. Lastly, small amounts of Canada thistle (*Cirsium arvense*) can be found in the refuge (Johnson, 2002).

There are no federally-protected plant species found within the refuge.

3.3.2 *Environmental Consequences*

Vegetation impacts were qualitatively assessed using literature reviews and quantitatively assessed by acres impacted.

3.3.2.1 Alternative 1 – No Action

Under the No Action Alternative, hazardous fuel loadings would continue to accumulate in the refuge. White fir would continue to replace ponderosa pine and other mixed conifer species,

such as Douglas fir and sugar pine. Existing high densities of trees would continue to stress the forest stands and make them more susceptible to bark beetle infestations. Habitat diversity and plant species diversity in the refuge would decline in the absence of thinning or prescribed fire treatments. The development of large trees with preferred roosting and nesting characteristics would be retarded. Finally, forest communities with their associated plant species would continue to transition from fire-tolerant, shade-intolerant species to fire-intolerant, shade-tolerant ones.

3.3.2.2 Alternative 2 – Proposed Action

Thinning and prescribed fire activities would occur on approximately 2,400 acres of the refuge under this alternative.

The restoration of the historic fire regime to the ponderosa pine and mixed conifer ecosystems would enhance the variety and diversity of native plant species and habitats. Those plant communities (ponderosa pine and mixed conifer) adapted to high frequency, low-severity fires would be favored with prescribed fire. Fire-intolerant species, such as white fir, would be reduced in number and forest communities would begin to transition back to ponderosa pine communities and mixed conifer communities with higher percentages of ponderosa pine, sugar pine, Douglas fir, and incense cedar and lower percentages of white fir. Native grasses and forbs would also increase in the understory, while high frequency prescribed fires would reduce the numbers of native shrub species like sage brush, bitterbrush and manzanita (*Arctostaphylos uva-ursi*) in the short term. Prescribed fire would also release nutrients into the soil and the fertilization effects of ash would provide an important source of nutrition for vegetation in the area (Vogl, 1979; Wright and Bailey, 1980). Finally, prescribed fire would kill some trees and help replenish the supply of standing dead trees (snags) in the refuge. Snags would be preserved unless they posed a risk to human health and safety and were deemed hazardous.

Thinning activities would focus on small understory trees, which would reduce tree densities and help return some areas to an open park-like structure characteristic of pre-European settlement ponderosa pine forests. At least 15% of the treatment areas would be maintained as clumps, or thickets, of trees; however, some minor thinning may be employed within those existing clumps. Some woody debris would be left on site to provide for wildlife habitat, particularly small rodents that provide a food base for owls, raptors, and other wildlife.

Thinning and prescribed fire activities would remove some dead, damaged, and stressed trees, which are weakened and susceptible to insect infestations, and would decrease the likelihood of spreading bark beetle infestations. Thinning activities would also decrease the likelihood of large, high-intensity fires in the future that could result in large areas of dead and dying trees, which in turn, could lead to an increased likelihood of bark beetle infestation.

Suppression activities that resulted in soil disturbance (fire lines) would make those disturbed areas more susceptible to noxious weed infestation. Disturbed areas would be monitored for noxious weed infestation and, in the event of noxious weed colonization, would be treated with appropriate management techniques.

Generally, the forest stands in the refuge would contain lower amounts of surface and ladder fuels, as well as larger crown spacing. These characteristics provide for more healthy forest stands, enable them to better withstand mixed or high-severity wildland fires, and help prevent surface fires from becoming pervasive and destructive crown fires. By reducing stand densities, and improving the overall health and vigor of the remaining trees, the Fish and Wildlife Service would promote the development of large trees, primarily ponderosa pine and Douglas fir, that would provide the characteristics preferred by nesting and roosting bald eagles - older, taller, and larger diameter trees with diffuse crowns and a greater number of exposed, large limbs relative to other trees in a stand (Dellasala et. al., 1987; USFWS, 1996).

3.3.2.3 Alternative 3

General vegetation impacts under Alternative 3 would be similar to those described under Alternative 2, however, the exclusion of prescribed fire would not result in the restoration of the natural fire regimes to the ponderosa pine and mixed conifer communities. In its absence, conditions would continue to favor white fir regeneration and development. Thinning efforts would provide a degree of hazardous fuels reduction, but less than that provided for under Alternative 2. Forest health would be improved with a reduction in tree densities, however, thinning treatments alone as a fire surrogate would not fully restore forest communities on the refuge that were comprised primarily of fire-tolerant, shade-intolerant plant species. Habitat and species diversity would continue to decline in the absence of prescribed fire.

3.4 WILDLIFE

3.4.1 *Affected Environment*

A variety of wildlife resources inhabit the forest and meadows of Bear Valley National Wildlife Refuge including ungulates, small mammals, birds, reptiles, and amphibians. Some common species include coyote (*Canus latrans*), mule deer (*Odocoileus hemionus*), and bald eagle.

The Klamath Basin supports as many as 1,100 over-wintering eagles between mid-October and April, and the refuge supports as much as 64% of that population. The location of the roosting sites on the refuge protects the eagles from harsh winter winds, provides access to an unlimited food source (over-wintering waterfowl), and contains a number of old, tall, and large diameter trees, preferred habitat for eagle roosting. The combination of these characteristics makes the Bear Valley National Wildlife Refuge possibly the single most important winter roosting site for bald eagles in the lower 48 states. This federally-endangered species also has several active nests on the refuge.

In the recent past, the Fish and Wildlife Service conducted surveys for Northern spotted owl (*Strix occidentalis*) on the refuge, however, no birds were located. Spotted owls are generally found below 5,000 feet, yet the majority of old-growth and mature forest on the refuge is located at elevations above 5,000 feet. In addition, the understory is too dense for foraging or navigation by spotted owls (Weekley, 1992).

The bald eagle is the only known federally-listed species to inhabit the refuge.

3.4.2 *Environmental Consequences*

Wildlife impacts were qualitatively assessed using presence/absence determinations, literature reviews, and mitigation measures.

3.4.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any direct or short-term indirect impacts to wildlife. In the long-term, the old-growth forest stands that provide essential roosting and nesting habitat for the bald eagle would be subjected to an increasing probability of high-severity catastrophic fire that could destroy the forest stands in the refuge. Such an event would significantly affect the critical habitat of the bald eagle in the refuge.

Generally, wildlife habitat would continue to degrade and species diversity would continue to decrease in the absence of fire hazard reduction activities.

3.4.2.2 Alternative 2 – Proposed Action

Proposed activities with the potential to impact wildlife include building fire lines, fire retardant and/or foam use, thinning, and prescribed fires.

Habitat conditions for many wildlife species that inhabit ponderosa pine and mixed conifer would improve with the restoration of the historic high frequency, low-intensity fire regime characteristic of the these forest stands. Such a fire regime would help restore and enhance the variety and diversity of native plant and wildlife habitats. Nutrients released to plants through the fertilization effects of ash would provide an important source of nutrition for wildlife in the area. While some trees would be killed from the effects of fire, these dead standing trees (snags) would be left as these provide important habitat for a variety of wildlife species. Some woody debris would also be left on site for wildlife habitat.

Fire hazard reduction activities could result in the temporary displacement of wildlife or isolated mortality of individuals. The loss of individuals, however, would not jeopardize the viability of the populations on and adjacent to the refuge. Thinning of the ponderosa pine stands would reduce the percentage of canopy closure and foster a more productive understory. By leaving at least 15% of treatment areas in thickets (clumps) per recommendations from the Oregon Department of Fish and Wildlife, hiding cover would be maintained for mule deer and impacts to the resident populations would be minor.

Fire hazard reduction activities would benefit the bald eagle in a variety of ways. In the short-term, thinning and prescribed fire would remove much of the hazardous fuels on the refuge and lessen the potential in the short-term that the roost and nest trees would be destroyed in a large, high-severity fire. There are not anticipated to be any impacts on roosting eagles during fire hazard reduction activities since they would not occur during the roosting season (November 15-April 1). There would be the possibility of minor impacts on any nesting eagles within the refuge if thinning and/or prescribed fire activities were conducted on some stands during the spring and summer months following consultation with and clearance from Fish and Wildlife Service

endangered species biologists. Any impacts would be temporary and minor in light of the mitigation measures to be employed during such activities (1/2 mile buffer from active nests and immediate cessation of work or suppression of prescribed fire in the event of a disturbance).

In the long-term, thinning and prescribed fire would encourage the growth of large diameter ponderosa pine, Douglas fir, and other conifer species, and would provide for future nesting and roosting habitat for the bald eagle. Fish and Wildlife Service managers would revise their thinning prescription in this proposed project if monitoring efforts associated with fire hazard reduction efforts within the actual sub-roosts indicated that such a revision was necessary to protect and provide for the eagles (adaptive management).

Management activities between May 15 and August 1 would likely impact some migratory birds nesting on the refuge, however, the limited extent of thinning operations to be conducted during the breeding season would not jeopardize the breeding population of a particular migratory bird species in the region. The Fish and Wildlife Service is currently developing procedures and policy guidance on the issue of protecting migratory birds. Any actions undertaken by the Fish and Wildlife Service under this alternative would be modified, if necessary, to be consistent with the procedures and recommendations that arise from the guidelines that are being developed (Laye, 2002). Other than the bald eagle, there are no other known highly-sensitive migratory bird species that breed within the refuge.

3.4.2.3 Alternative 3

General wildlife impacts under Alternative 4 would be similar to those described under Alternative 2, however, the exclusion of prescribed fire would result in the continued decline of wildlife habitat and species diversity, as well as a higher retention of hazardous fuels in the refuge. Thinning overly dense forest stands, removing some ladder fuels and surface fuels, and increasing crown spacing between the conifers would greatly reduce the potential for surface fires reaching the crowns and becoming sustained and destructive high-severity crown fires. These efforts would, in turn, help protect existing and promote future bald eagle nesting and roosting sites in the refuge.

3.5 AIR QUALITY

3.5.1 *Affected Environment*

Under the terms of the 1990 Clean Air Act amendments, the Bear Valley National Wildlife Refuge is designated as a Class II quality area. By definition, Class II areas of the country are set aside under the Clean Air Act, but identified for somewhat less stringent protection from air pollution damage than Class I areas. The primary means by which the protection and enhancement of air quality is accomplished is through implementation of National Ambient Air Quality Standards (NAAQS). These standards address six pollutants known to harm human health including ozone, carbon monoxide, particulate matter, sulfur dioxide, lead, and nitrogen oxides (USDA, 2000a). The City of Klamath Falls retains a non-compliance designation for particulate matter from air quality problems associated primarily with wood-burning stoves (Calkins, 2002).

3.5.2 *Environmental Consequences*

Air quality impacts were qualitatively assessed upon review Fish and Wildlife Service best management practices to reduce air emissions, State of Oregon prescribed fire procedural requirements, and the extent of proposed prescribed fire activities under all the alternatives. The Fish and Wildlife Service will quantify projected air emissions for any given prescribed fire prior to ignition.

3.5.2.1 Alternative 1 – No Action

There would not be any direct air quality impacts under the No Action Alternative. In the absence of fire hazard reduction, air quality impacts from a high-severity wildfire would likely be greater than those experienced in treated forest stands.

3.5.2.2 Alternative 2 – Proposed Action

Smoke consists of dispersed airborne solids and liquid particles, called particulates, which could remain suspended in the atmosphere for a few days to several months. Particulates can reduce visibility and contribute to respiratory problems. Very small particulates can travel great distances and add to regional haze problems. Regional haze can sometimes result from multiple burn days and/or multiple owners burning within an airshed over too short a period of time to allow for dispersion.

Prior to any prescribed fire, the Fish and Wildlife Service must register the proposed burn with the Oregon Department of Forestry and provide information on several parameters, such as the location of the burn, expected size, fuel type(s), fuel loadings, etc. Following the prescribed fire, the agency must again register results of the burn with the department. This information includes parameters such as total acreage burned and fuel moisture levels. The Fish and Wildlife Service is responsible for preparing its own smoke management plan, a component that is not required by the State during the registration process. As part of any smoke management plan, the Fish and Wildlife Service will not conduct prescribed fires on the refuge when there would not be adequate smoke dispersion, or when wind direction would carry smoke toward Klamath Falls or Keno.

The Department of Forestry prepares prescribed fire advisories each day regarding weather conditions and recommended burn prescriptions. The advisories are developed to help effectively manage smoke and resulting air quality impacts, as well as to provide information on fire conditions and danger. Recognition of the cumulative effects from multiple prescribed fires on any particular day is embedded in the advisories. For example, the advisories discuss maximum number of acres to be burned at a particular site, minimum spacing between fire sites, maximum tonnage of fuels to be burned, etc. The advisories also discuss weather conditions and the potential for adequate smoke dispersion (Ziolko, 2002). Fish and Wildlife Service compliance with the advisories is voluntary, however, in the interest of human health and safety and compliance with Oregon and federal air quality laws, the Fish and Wildlife Service will adhere to the advisories.

For prescribed fires, there are three principle strategies to manage smoke and reduce air quality effects. They include:

1. Avoidance - This strategy relies on monitoring meteorological conditions when scheduling prescribed fires to prevent smoke from drifting into sensitive receptors, or suspending burning until favorable weather (wind) conditions. Sensitive receptors can be human-related (e.g. campgrounds, schools, churches, and retirement homes) or wildlife-related (threatened and endangered species and their critical habitats);

2. Dilution – This strategy ensures proper smoke dispersion in smoke sensitive areas by controlling the rate of smoke emissions or scheduling prescribed fires when weather systems are unstable, not under conditions when a stable high-pressure area is forming with an associated subsidence inversion. An inversion would trap smoke near the ground; and

3. Emission Reduction – This strategy utilizes techniques to minimize the smoke output per unit area treated. Smoke emission is affected by the number of acres burned at one time, pre-burn fuel loadings, fuel consumption, and the emission factor. Reducing the number of acres that are burned at one time would reduce the amount of emissions generated by that burn. Reducing the fuel beforehand reduces the amount of fuel available. Prescribed burning when fuel moistures are high can reduce fuel consumption. Emission factors can be reduced by pile burning or by using certain firing techniques such as mass ignition.

If weather conditions changed unexpectedly during a prescribed burn, and there was a potential for violating air quality standards or for adverse smoke impacts on sensitive receptors (schools, churches, hospitals, retirement homes, campgrounds, wilderness areas, and species of threatened or endangered wildlife), the refuge would implement a contingency plan, including the option for immediate suppression. Considering 1) the proposed action would result in prescribed fire on a relatively small number of acres, approximately 2,400 acres at a maximum, 2) burning in the refuge would occur over a 5-year period at a minimum, and 3) the Fish and Wildlife Service would adhere to Oregon Department of Forestry advisories and management strategies to minimize smoke emissions, prescribed fire activities would not violate national or state emission standards and would cause very minor and temporary air quality impacts. The greatest threat to air quality would be smoke impacts on sensitive receptors, however, the paucity of sensitive receptors adjacent to the refuge minimizes this potential air quality impact.

Vehicle use associated with thinning operations would increase fugitive dust levels on the access roads. To mitigate for any potential increase, the Fish and Wildlife Service will require that the access roads be wetted once a day during hauling operations associated with thinning.

3.5.2.3 Alternative 3

Under Alternative 3, there would be very minor air quality impacts from vehicles associated with thinning activities. In the absence of fire hazard reduction, air quality impacts from a high-severity wildfire would likely be greater than those experienced in treated forest stands.

3.6 NOISE

The loudest sounds that can be detected comfortably by the human ear have intensities that are 1 trillion (1,000,000,000,000) times larger than those of sounds that can just be detected. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes very unwieldy. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level.

Certain facilities, communities, and land uses, (sensitive receptors) are more sensitive to a given level of noise than others. Impacts from noise production are generally assessed with respect to changes in noise levels experienced at sensitive receptors. Different types of sensitive receptors vary in their acceptance of noise disturbance. As a result, noise impacts for different receptors are often assessed using different noise level standards.

3.6.1 *Affected Environment*

There are several potential noise sources associated with thinning and prescribed fire activities for all the action alternatives. The dB sound levels from the equipment at a distance of 50' includes the following: chainsaw (78 dB), harvester/forwarder (86 dB), and engine/truck (91 dB). While there are no campgrounds, churches, wilderness, or other human-related sensitive receptors in or immediately adjacent to the refuge, there were 3 bald eagle nesting sites in the refuge boundaries in 2001, as well as numerous roosting sites for over-wintering eagles.

3.6.2 *Environmental Consequences*

Noise impacts were qualitatively assessed with respect to the location of sensitive receptors and mitigation measures.

3.6.2.1 Alternative 1 – No Action

There would not be any noise-related impacts under the No Action Alternative.

3.6.2.2 Alternative 2 – Proposed Action

There would not be any noise-related impacts to roosting bald eagles on or adjacent to the refuge in light of the mitigation measure to concentrate thinning activities between August 15 and November 15. There would be the possibility of minor impacts on nesting eagles within the refuge if thinning and/or prescribed fire activities were conducted on some stands during the spring and summer months. Any impacts would be minor in light of the mitigation measures to be employed during such activities (1/2 mile buffer, no direct line of sight, immediate cessation of work or suppression of prescribed fire in the event of a disturbance).

The general public would not be exposed to continual sound levels greater than 90 dB, however equipment workers may experience levels greater than 90 dB. Those workers operating the equipment would be required to mitigate any possible adverse noise impacts by using noise reduction devices such as earplugs.

Several residences would be subjected to elevated noise levels from large vehicles hauling out felled trees. To minimize the noise effects of the large vehicles, traffic would be required to employ both north and south access roads. In addition, operation of the large vehicles would be restricted to daylight hours, generally 8:00 am – 5:00 pm.

3.6.2.3 Alternative 3

General noise impacts under Alternative 2 would be similar to those described under Alternative 3.

3.7 TRANSPORTATION

3.7.1 *Affected Environment*

Bear Valley National Wildlife Refuge can be accessed with two secondary roads on the southern boundary and one secondary road on the northern boundary. The primary southern access road is commonly called Bear Valley Road, and several residences are located on it. Once it enters the refuge, the Fish and Wildlife Service refers to it as Road #20. The northern access road does not have a common name and is referred to as Road #10 within refuge boundaries. A small network of secondary roads also extends throughout much of the refuge (see Figure 2-1). None of the access roads or other roads in the refuge are paved, however Road #20 is graveled for several miles of its length. Traffic on the access roads consists primarily of resident and Fish and Wildlife Service vehicles.

3.7.2 *Environmental Consequences*

Transportation impacts were qualitatively assessed in light of the extent of local traffic on the access roads and mitigation measures.

3.7.2.1 Alternative 1 – No Action

There would not be any transportation related-impacts under the No Action Alternative.

3.7.2.2 Alternative 2 – Proposed Action

Under this alternative, roads that are closed may be temporarily re-opened for the duration of treatment activities. There would be the potential for minor conflicts between vehicles associated with thinning efforts and local traffic on unimproved access roads. Additionally, heavy vehicle use would likely impact the access roads. To mitigate potential adverse impacts from hauling activities associated with thinning activities, road improvements would be made at the end of the project, where necessary, to repair damage, and both north and south access roads (FWS roads #10 and #20 respectively) would be used for hauling out felled logs. Additionally, vehicles would be restricted to a 25-mph speed limit on the access roads.

3.7.2.3 Alternative 3

General transportation impacts under Alternative 3 would be similar to those described under Alternative 2.

3.8 SOCIOECONOMICS

3.8.1 *Affected Environment*

Bear Valley National Wildlife Refuge is located in Klamath County, which has a population of 63,775 (USCB, 2001a). Approximately 44,000 people reside within the city limits and in the surrounding urban growth boundary of Klamath Falls (Klamath, 2001a). Agriculture, timber, and related businesses are major elements of the county's economy, as is transportation. Tourism is probably the fourth most important industry (SCORP, 1999). In addition to the refuge, several other National Wildlife Refuges, a Volcanic Scenic By-Way, Crater Lake National Park, and the Klamath Tribe's Klamoya Casino bring visitors to the county each year. Timber employment is not expected to increase in the near future, and the county looks to increasing economic diversification to aid economic growth. Tourism and recreation are an important part of this mix.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to identify and address any disproportionately high adverse human health or environmental effects of its projects on minority or low-income populations.

Minority populations constitute approximately 13% of the total population in this county. Using the Census Bureau's categories, the largest racial group is American Indian and Alaska native (4%), followed by those who said they were of two or more races (3%), and those who said they were some other race (3%). Asian, Black or African American, and Native Hawaiian groups each made up less than 1% of the county's population. In addition, 8% of the population identified themselves as Hispanic or Latino; persons in this category can be of any race.

The median household income for Klamath County was $23,054 in 1989 (USCB, 2001b). At that time, 9,494 of 56,707 individuals, or approximately 17%, were reported to be living in poverty in the county. The county reported an unemployment rate of 8.1% (Klamath, 2001b) significantly higher than the national average of 4.4% reported by the U.S. Bureau of Labor Statistics for May of 2001.

There are approximately 80 residences and structures within one mile of the refuge boundaries, with additional residential lots being sold and developed. Homeowners in the one-mile radius are not predominantly minority or low-income populations.

The Fish and Wildlife Service proposes to enter into contracts with outside parties to conduct thinning operations on the refuge. Thinning activities would not be performed under commercial contracts where the Fish and Wildlife Service would be paid for the value of any timber that was felled and removed. Rather, the Fish and Wildlife Service would pay the contractor(s) a fixed price

per acre treated, to include a reduction in price for the expected commercial value of any timber in the areas to be treated. Estimates of stumpage value (value of the logs minus the logging costs) of timber at Bear Valley by the Bureau of Land Management range from $120,000 to $600,000 depending on how large an area is treated (USFWS, 1996).

The USFWS currently pays Klamath County a percentage of Bear Valley National Wildlife Refuges' appraised value under 50 CFR Part 34, Refuge Revenue Sharing With Counties. Under this authority, the Fish and Wildlife Service must pay the county 25% of the net receipts from any revenue producing activity, such as the sale of timber from refuge lands if this amount is greater than the amount currently being paid. Depending on the amount of logging done and the net proceeds per year from the timber sale, the Fish and Wildlife Service may be required to pay additional dollars to Klamath County. These additional payments would only be required in the years that 25% of the net receipts exceeds the normal payment schedule.

3.8.2 *Environmental Consequences*

Socioeconomic impacts were quantitatively assessed using U.S. Census Bureau data on personal income, population data, and poverty measures, as well as information on past thinning operations in the Bear Valley National Wildlife Refuge.

3.8.2.1 Alternative 1 – No Action

There would not be any direct socioeconomic impacts under the No Action Alternative. In the long-term, the absence of fire hazard reduction on the refuge could lead to high-severity fires that threaten private residences adjacent to and near the refuge. Revenue sharing with Klamath County would not be affected under this alternative, nor would there be a highly disproportionate impact on minority or economically disadvantaged persons. If wildfires destroy the roosting sites in Bear Valley, the local economy may be impacted since the eagles attract tourists to the area.

3.8.2.2 Alternative 2 – Proposed Action

Percentages of minority or economically disadvantaged persons in Klamath County are below the national averages for these categories, and the probability of a highly disproportionate impact to these populations resulting from the implementation of fire hazard reduction activities would be small.

It is anticipated that any commercial operations to aid in thinning activities on the refuge would have a positive effect on the local economy, however, it is unclear whether timber that is removed would be processed in the local area or that new jobs would be created. Considering the DBH limits imposed by the Fish and Wildlife Service for the proposed activities and subsequent paucity of highly valued commercial timber, and considering the Fish and Wildlife Service's experience with similar contracts on the Bear Valley National Wildlife Refuge, it is not anticipated that the revenues generated from the contracts would represent greater than 2% of the local or regional economy, or increase revenue sharing with the County.

3.8.2.3 Alternative 3

General socioeconomic impacts under Alternative 3 would be similar to those described under Alternative 2.

3.9 Human Health and Safety

3.9.1 *Affected Environment*

Prior to the ignition of any prescribed fire in the refuge, all the burn parameters of the existing and approved prescribed fire burn plan must be met to ensure a safe and effective prescribed fire. In addition, staff would advise the public of the time and extent of the proposed burn. In the event of potentially hazardous escaped prescribed fire within the refuge, the refuge manager would coordinate public notification efforts. The extent of public notice would depend on the specific fire situation. In every case, assuring visitor, refuge staff, and adjacent residents' safety would take priority over other activities.

3.9.2 *Environmental Consequences*

Human health & safety impacts were qualitatively assessed through determination of activities, equipment and conditions that could result in injury, literature review of type and extent of injury caused by equipment and conditions, and in light of mitigation measures and best management practices.

3.9.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any direct or short-term indirect human health and safety impacts. In the long-term, the absence of fire hazard reduction efforts would increase the potential for a high-severity, catastrophic wildfire that could adversely impact human health and safety.

3.9.2.2 Alternative 2 – Proposed Action

Factors most likely to adversely impact firefighter health and safety include activities associated with prescribed fire and, if necessary, wildland fire suppression efforts (accidental spills, injuries from the use of fire-fighting equipment, smoke inhalation, and, in severe cases, burn injuries from prescribed or wildland fires). Impacts to the public could include smoke inhalation, and in severe cases, injuries from wildland fires.

Accidental spills of fire retardants and foams are the most likely to adversely impact human health & safety. Fire retardants used in controlling or extinguishing fires contain about 85% water, 10% fertilizer, and 5% minor ingredients such as corrosion inhibitors and bactericides. Fire suppressant foams are more than 99% water. The remaining 1% contains surfactants, foaming agents, corrosion inhibitors, and dispersants. These qualified and approved wildland fire chemicals have been tested and meet specific requirements with regard to mammalian toxicity as determined by acute oral and dermal toxicity testing as well as skin and eye irritation tests

(USDA, 2001). However, they are strong detergents, and can be extremely drying to skin. All currently approved foam concentrates are irritating to the eyes as well. Application of a topical cream or lotion can alleviate the effects of a retardant, and protective goggles can prevent any injury to the eyes when using foams.

Fire line construction can pose safety threats to firefighters. Injuries can occur from the use of equipment as well as from traveling overland to targeted areas for firefighting efforts during suppression efforts. While each of the crew is trained in the use of firefighting equipment, accidental injuries may occur from time to time. Strict adherence to guidelines concerning firefighter accreditation, and equipment and procedure safety guidelines would minimize accidents.

Smoke inhalation can also pose a threat to human health & safety. Smoke from wildland fires is composed of hundreds of chemicals in gaseous, liquid, and solid forms. The chief inhalation hazard appears to be carbon monoxide (CO), aldehydes, respirable particulate matter with a median diameter of 2.5 micrometers (PM2.5), and total suspended particulate (TSP). Adverse health effects of smoke exposure begin with acute, instantaneous eye and respiratory irritation and shortness of breath, but can develop into headaches, dizziness, and nausea lasting up to several hours. Based on a recent study of firefighter smoke exposure, most smoke exposures were not considered hazardous, but a small percentage routinely exceeded recommended exposure limits for carbon monoxide and respiratory irritants (USDA, 2000b).

Use restrictions applied to areas of wildland fires or prescribed fires would minimize or eliminate public human health & safety concerns resulting from smoke exposure and fire injuries. When using prescribed fire, mitigation measures, such as construction of fire lines, the presence of engines, and strict adherence to prescribed burn plans, would minimize the potential for an out-of-prescription burn or escape. Elements of the prescribed burn plan that relate to ensuring a safe burn include such measures as fuel moisture, wind speed, rate of fire spread, and estimated flame lengths. While the potential for a fire escape will always exist when conducting prescribed fires, that potential is extremely small. Recent statistics summarized by the Boise Interagency Fire Center report that approximately 1% of prescribed fires on federal lands required suppression activities of some kind. In most cases these prescribed fires jumped a control line and suppression tactics were successfully used to control them. Out of the 1% of prescribed fires that required suppression, 90% were controlled without incident. Statistically, this result leaves about 0.1% of prescribed fires that required major suppression actions (Stevens, 2000).

3.9.2.3 Alternative 3

The general impacts to human health & safety under Alternative 3 would be similar to those described under Alternative 2. The exclusion of prescribed fire (broadcast burning) to reduce ground fuels would eliminate the possibility of an out-of-prescription burn or fire escape. Since slash pile burning would be conducted during winter, the potential for escape from a slash pile burn and for a subsequent wildfire would be very low. In the long-term, however, fuels buildup in the absence of prescribed fire would result in more intense and severe wildland fires that could be more difficult to suppress.

3.10 Cultural Resources

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their proposals on historic properties, and to provide state historic preservation officers, tribal historic preservation officers, and, as necessary, the Advisory Council on Historic Preservation a reasonable opportunity to review and comment on these actions.

3.10.1 *Affected Environment*

Based on a 2001 cultural resources survey of the proposed treatment area in Bear Valley National Wildlife Refuge, eight historic archaeological sites were identified and recorded. In addition, ten isolated artifacts (9 historic and 1 prehistoric) were located in the proposed project area. Of the 8 historic archaeological sites, one was a former base camp, one a former field camp, one a collapsed wooden structure, and the remaining five were tin can dumps (Zerga, 2002). All 8 sites have an undetermined eligibility for inclusion in the National Register of Historic Places.

Protection measures for sites are keyed to determinations of each site's eligibility for inclusion in the National Register of Historic Places. Officially listed heritage sites and sites determined eligible or with an undetermined eligibility are of concern. Ineligible sites are dropped from management concerns, and determinations of effect on these properties are not addressed in this analysis. The Fish and Wildlife Service will exercise Section 106 for potential effects of fire-related projects on cultural resources that are eligible and sites with an undetermined eligibility

3.10.2 *Environmental Consequences*

Cultural resource impacts were qualitatively assessed through a presence/absence determination of significant cultural resources and mitigation measures to be employed during thinning and prescribed fire activities.

3.10.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any direct impacts to cultural resources. The absence of fire hazard reduction in the refuge, and the corresponding fuels buildup, would result in more intense and severe wildland fires, which have an increased potential for affecting cultural resource sites, especially those historic sites with exposed burnable material (wood).

3.10.2.2 Alternative 2 – Proposed Action

Proposed activities with the potential to impact cultural resources include building fire lines, thinning, and prescribed fire.

Sites that could be potentially affected during thinning, fire line construction and slash piling would be avoided to eliminate potential damage. Site boundaries would be clearly marked for avoidance, and sites would be monitored during and after completion of the activities. Because these sites would be avoided, there would be no effect to these cultural resource sites.

If needed, a fire line would be built around the perimeter of sites with combustible materials (i.e. exposed wood). Fuels would be removed from the interior of the sites and from the area surrounding the site to maintain low burn temperatures. Back burning may also take place around the site to reduce fuel loading.

There would be the potential for fire hazard reduction activities to affect unrecorded cultural resources within the refuge.

3.10.2.3 Alternative 3

General impacts to cultural resource sites under Alternative 3 would be similar to those described under Alternative 2. In addition, the absence of prescribed fire in the refuge, and the corresponding fuels buildup would result in more intense and severe wildland fires, which have an increased potential for affecting cultural resource sites. As with the other action alternatives, there would be the potential for fire management activities affecting unrecorded cultural resource sites.

3.11 Cumulative Effects

The cumulative effects analysis for the Fire Hazard Reduction Project environmental assessment considers the past, present, and reasonably foreseeable future actions on land uses that could add to (intensify) or offset (compensate for) the effects on the resources and that may be affected by the alternatives. Cumulative effects vary by resource and the geographic areas considered here are generally the refuge and areas adjacent to the refuge. In some instances, activities may result in both negative and positive impacts when considering the short and long-terms. As a result, some resource categories in Table 3-1 show both positive and negative impacts resulting from a particular activity. The information provided in Table 3-1 is the basis for the cumulative effects described in Table 3-2.

Table 3-1 Affected Impact Topics and Activities/Land Uses
Contributing to Fire Hazard Reduction Cumulative Effects

	Soils	Water Resources	Vegetation	Wildlife	Air Quality	Noise	Trans.	Socio-economics	Human Health & Safety	Cultural Resources
Past, present, and future prescribed fires and thinning on the refuge	+ -	+ -	+ -	+ -	-		-		+ -	
Lightning & human-caused wildfires	+ -	+ -	+ -	+ -	-		-	-	+ -	+ -
Wildfire suppression past, present, future	-	+ -	+ -	+ -	+	-	+	+ -	+ -	+ -
Past logging on the refuge	+ -	-	+ -	+ -		-	-	+	-	-
Past agricultural on the refuge (tree farm)	+	+ -	+ -	+ -				+		+ -
Past, present and future prescribed fire and logging activities in adjacent lands	+ -	+ -	+ -	+ -	-	-	-	+	+ -	+ -
Hunting on the refuge				+ -		-		+		
Road improvements on the refuge	+ -	+ -	-	-	+	-	+	+	+	
Past, present, and future development adjacent to the refuge	-	-	-	-	-	-	-	+	-	

DIRECT/INDIRECT EFFECTS KEY: (+) Positive/beneficial; (-) Negative/detrimental; (Blank) Neutral/no effect

Table 3-2 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
Soils	Adverse soil impacts (soil erosion or loss) from past road construction, logging, willdland fires and suppression efforts; Beneficial soil impacts from past wildland and prescribed fires (nutrification of soils)	Prescribed fire and thinning activities would have temporary and minor adverse effects on soils (soil erosion and compaction), but beneficial effects as well over the short and long-terms (soil development and soil nutrification)	Suppression efforts to contain large wildfires could adversely impact soils (compaction, erosion from firebreaks, etc.); graveling roads may reduce soil erosion soils	Soils would improve over time with soil development and nutrification from prescribed fires; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 would contribute the most to soil cumulative impacts, while Alternative 1 would contribute the least
Water Resources	Past logging, prescribed fire, thinning, and road construction impact water resources; past and current development intensify use of groundwater	Thinning and prescribed fires would have minor direct impacts on water resources (intermittent streams)	Future prescribed fire and thinning treatments to benefit eagle roosting and nesting will continue to have very minor water resource impacts	Minor effect on water resources; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 would contribute the most to water resources cumulative impacts, while Alternative 1 would contribute the least
Vegetation	Natural fuel loading increased in absence of historic low-severity, high frequency fire regime; past logging and wildfire suppression lead to decline in native plant habitat and diversity, transition from fire tolerant plant species to fire-intolerant plant species, increased canopy closure, and reduced forest stands with old growth characteristics	Thinning and prescribed fire would decrease hazardous fuel loadings and promote the development of large trees; native grass and forb species would be favored in the understory; forest stand structure in some areas would return to historic conditions	Thinning and prescribed fire efforts in adjacent lands would reduce hazardous fuel loadings and help restore historic fire regime to adjacent ponderosa pine and mixed conifer stands; wildland fire suppression efforts will continue to alter historic fire regime for ponderosa pine and mixed conifer forest communities	Ponderosa pine and mixed conifer communities and habitat diversity would continue to improve; fuel loadings would pose a reduced fire danger; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 would contribute the most to vegetation cumulative impacts, while Alternative 1 would contribute the least
Wildlife	Fire suppression efforts within the refuge degraded fire-tolerant wildlife habitat and diversity and degraded favorable roosting and nesting habitat for bald eagles; minor loss in big game species from past and present hunting activities	Thinning and prescribed fire would result in minor, short-term disturbance and displacement with minimal loss of individuals; improved habitat and increased wildlife diversity with restoration of historic fire regime; very minor or no short term impacts on threatened and endangered species (bald eagle), with long-term benefit to eagles roosting and nesting site protection and development	Thinning and prescribed fire efforts in adjacent lands would help restore historic fire regime to adjacent ponderosa pine and mixed conifer stands and benefit wildlife habitat and species diversity; Continued housing development and road construction outside the refuge would fragment wildlife habitat	Wildlife habitat and diversity increases; fire hazard reduction does not result in significant cumulative impacts; Alternatives 2 would contribute the most to wildlife cumulative impacts, while Alternative 1 would contribute the least

Table 3-2 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
Air Quality	Past wildland and prescribed fires on and off the refuge contribute to temporary deterioration in air quality and visibility; minor emissions from vehicle traffic (local and tourist); emissions from wood stoves resulted in significant air quality impacts in the County	Prescribed fire emissions would result in minor, short-term air quality and visibility impacts; fugitive dust levels would increase from operation of large vehicles associated with thinning activities	Future wildland fires and prescribed fires on adjacent forest service lands would contribute to temporary deterioration in air quality and visibility	Air quality standards would not be violated; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 would contribute the most to soil cumulative impacts, while Alternatives 1 and 3 would contribute the least
Noise	Past and present hunting, residential development, road construction, and thinning activities resulted in short-term noise impacts; thinning and logging activities on adjacent lands result in noise impacts	Thinning and suppression activities would result in temporary, but insignificant, noise impacts to sensitive receptors (nesting/roosting bald eagles)	Hunting on the refuge continues to be a long-term source of minor noise impacts; thinning and/or commercial logging on adjacent forest service lands will result in noise impacts	Noise sources and levels in the refuge would increase in the short-term; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 and 3 would result in similar noise impacts, while the No Action Alternative would result in no impacts
Transportation	Fish and Wildlife Service and Forest Service roads improve access to the refuge	Minor conflicts with thinning activities and recreation traffic; minor damage to existing un-improved access roads	Road improvements and/or acquisition by the Fish and Wildlife Service benefits access to area	Minor conflicts between management and local traffic during thinning and prescribed fire activities; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 and 3 would result in similar transportation impacts, while the No Action Alternative would result in no impacts
Socio-economics	Past and present hunting and wildland fire suppression activities contribute to beneficial socioeconomic impacts; establishment of the refuge promotes ecotourism in the region; past logging and agricultural activities in and adjacent to the refuge provides revenue to local economy	Minor impacts to local and regional economies from thinning activities	Similar effects as described in Past and Present Actions	Thinning activities result in minor impacts to local and regional economy; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 and 3 would result in similar socioeconomic impacts, while the No Action Alternative would result in no immediate impacts
Human Health & Safety	Past wildland fire suppression efforts on the refuge and adjacent lands protected refuge staff, visitors, and adjacent residents; at the same time, those efforts have increased the fire hazard in the area and increased potential for high-severity wildfires	Thinning and prescribed fire activities may result in very minor impacts; long-term improvement in human health & safety with reduction in hazardous fuels	Increased residential development in the wildland urban interface heightens the potential for adverse safety impacts in light of wildland fire suppression efforts and lack of hazardous fuels removal on private lands	Human health and safety would improve over time with fuel treatments; fire hazard reduction would not result in significant cumulative impacts; Alternative 3 would contribute the most to human health and safety cumulative impacts, while Alternative 1 would contribute the least

Table 3-2 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
Cultural Resources	Establishment of the refuge helped protect cultural resources; past suppression efforts may have impacted un-recorded sites; access roads and visitation on refuge may have facilitated the illegal taking of some cultural resources	Fire hazard reduction treatments have the potential to impact un-recorded sites	Similar effects as described in Past and Present Actions	Cultural resources continue to be protected; fire hazard reduction would not result in significant cumulative impacts; Alternative 1 and 3 would contribute the most to cultural resources cumulative impacts, while Alternative 2 would contribute the least

Consultation and Coordination

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Scoping

Details of the scoping process and the issues that arose from it are described in Chapter 1, Section 1.4 – *Scoping Issues and Impact Topics*.

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GLOSSARY OF TERMS

Backfiring: When attack is indirect, intentionally setting fire to fuels inside the control line to contain a rapidly spreading fire. Backfiring provides a wide defense perimeter, and may be further employed to change the force of the convection column.

Basal Area: The amount of square footage in a forest stand at 4 1/2 feet above the ground.

Burning Out: When attack is direct, intentionally setting fire to fuels inside the control line to strengthen the line. Burning out is almost always done by the crew boss as a part of line construction; the control line is considered incomplete unless there is no fuel between the fire and the line.

Contingency Plans: Provides for the timely recognition of approaching critical fire situations and for timely decisions establishing priorities to resolve those situations.

Control Line: An inclusive term for all constructed or natural fire barriers and treated fire edge used to control a fire.

Crew: An organized group of firefighters under the leadership of a crew boss or other designated official.

Crown Fire: A fire that advances from top to top of trees or shrubs more or less independently of the surface fire. Sometimes crown fires are classed as either running or dependent, to distinguish the degree of independence from the surface fire.

Duff: The partially decomposed organic material of the forest floor beneath the litter of freshly fallen twigs, needles, and leaves.

Ecosystem: An interacting system of interdependent organisms and the physical set of set of conditions upon which they are dependent and by which they ae influenced.

Fire Behavior Forecast: Fire behavior predictions prepared for each shift by a fire behavior analysis to meet planning needs of fire overhead organization. The forecast interprets fire calculations made, describes expected fire behavior by areas of the fire, with special emphasis on personnel safety, and identifies hazards due to fire for ground and aircraft activities.

Fire Behavior Prediction Model: A set of mathematical equations that can be used to predict certain aspects of fire behavior when provided with an assessment of fuel and environmental conditions.

Fire Danger: A general term used to express an assessment of fixed and variable factors such as fire risk, fuels, weather, and topography which influence whether fires will start, spread, and do damage; also the degree of control difficulty to be expected.

Fire Ecology: The scientific study of fire's effects on the environment, the interrelationships of plants, and the animals that live in such habitats.

Fire line: The part of a control line that is scraped or dug to mineral soil.

Fire Management: The integration of fire protection, prescribed fire and fire ecology into land use planning, administration, decision making, and other land management activities.

Fire Occurrence: The number of wildland fires started in a given area over a given period of time. (Usually expressed as number per million acres.)

Fire Prevention: An active program conducted in-park and in conjunction with other agencies to protect human life, prevent modification, of the park ecosystem by human-caused wildfires, and prevent damage to cultural resources or physical facilities. Activities directed at reducing fire occurrence, including public education, law enforcement, personal contact, and reduction of fire risks and hazards.

Fire Retardant: Any substance that by chemical or physical action reduces flareability of combustibles.

Fire Risk: The probability that a wildfire will start as determined by the presence and activities of causative agents.

Fuel: The materials which are burned in a fire; duff, litter, grass, dead branchwood, snags, logs, etc.

Fuel Loading: Amount of dead fuel present on a particular site at a given time; the percentage of it available for combustion changes with the season.

Fuel Type: An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.

Heavy Fuels: Fuels of a large diameter, such as snags, logs, and large limbwood, which ignite and are consumed more slowly than flash fuels.

Human-Caused Fires: Refers to fires ignited accidentally (from campfires or smoking) and by arsonists; does not include fires ignited intentionally by fire management personnel to fulfill approved, documented management objectives (prescribed fires).

Intensity: The rate of heat energy released during combustion per unit length of fire edge.

Inversion: Atmospheric condition in which temperature increases with altitude.

Ladder Fuels: Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.

Litter: The top layer of the forest floor composed of loose debris, including dead sticks, branches, twigs, and recently fallen leaves or needles, little altered in structure by decomposition.

Monitoring Team: Two or more individuals sent to a fire to observe, measure, and report its behavior, its effect on resources, and its adherence to or deviation from its prescription.

Prescribed Fire: The skillful application of fire in a definite area under predetermined weather and fuel conditions to achieve specific management objectives.

Prescription: A written statement defining the objectives to be attained, the conditions of temperature, humidity, wind direction and speed, fuel moisture, etc.

Reburn: Subsequent burning of an area in which fire has previously burned but has left flareable light that ignites when burning conditions are more favorable.

Surface Fire: Fire which moves through duff, litter, woody dead and down, and standing shrubs, as opposed to a crown fire.

Wildfire: An unwanted wildland fire.

Wildland Fire: Any non-structure fire, other than prescribed fire, that occurs in the wildland. This includes both prescribed natural fires and wildfires.

Appendix A

Letter 1

Raymond D. Costic
20716 Keno Worden Rd.
Klamath Falls, Or. 97603
541 884-6777
rcostic@cvc.net

Klamath Basin Wildlife Refuge Complex Manager,

Dear Sirs,

This letter is in response to the March 22, 2002 Environmental assessment report. I want to applaud you continued efforts addressing the concerns that were brought up in prior meetings or written correspondence.

In the March 22 project assessment, you state that alternative #2 is the way to achieve the desired goals of the Fish and Wildlife Service in managing Bear Valley Wild life Refuge.

The following pages/sections (Air Quality/Transportation) are a concern to all of us who border the refuge's primary road (road 20) and private road known as "Bear Valley Road":

1.) page 1-10 " Thinning activities include the use of large TRUCKS"
2.) page 1-11 "public access minor issue 100-250 hunters annually
3.) page 2-3 Impact definitions table 2-1 "Air Quality –Transportation"
4.) page 2-5 Mitigation efforts-2.4.4 large vehicles restricted 8:00am-5:00pm
5.) page 2-6 Mitigation efforts 2.4.5 Transportation
   a. use both roads 10&20
   b. following conclusion, **road repairs as necessary**
   c. speed limit 25 refuge road

6) Page 3-12 EA analysis- Transportation - Heavy Large trucks will impact access road 20 and entrance road referred to as "Bear Valley Road"
7) Page 3-18 Cumulative effects Long term and short term

The sections indicate our road will be accessed by heavy trucks and numerous support vehicles and personnel for years to come. The report also indicates that tangible road damage will be repaired, **as necessary**, as **determined** by non-resident US Fish and Wildlife Service employees and the Air quality will be impacted, but minimally.

The road has been used for the last two years for logging and burning operations and past road damage by road graders, scraping off of important top layers of gravel, was never repaired. These operations also left exposed surface soils that have turned into super potholes and water holes that iced over in the winter months. The road was never fully repaired, **as necessary.** The road currently has a very uneven grade, is extremely dusty and foreign debris contributes to premature tire failure, i.e. railroad spikes.

Response to Letter 1

Our primary concern is the life of the road. Past efforts to restore or repair the road have been non-existent. Road restoration monies were spent on bridge replacement for heavy 80,000 lb logging trucks. A small amount of ¾ minus Gravel was put on the road after a local resident made a minor fuss about the condition the road was left in over the years.

It is with **apprehension** when we read your going to use this private easement and not state in a definitive manner how you are going to restore or improve. If you do have plans that will address our concerns we sure would like to talk to you about **them before you start the logging and burning....**

Again, our main concern is the continuing cumulative effects of the 10 Year Bald Eagle Refuge Improvement plan and it's impact on our homes and access to our homes.

In conclusion, as homeowner's we maintain the road with **current** residential traffic levels. In the years to come we will see exponential increases in public traffic, eagle viewers, logging trucks and government support vehicles **as the Plan is 10 year continuous.**

1-1

We are requesting that you come up with definitive corrective actions and / or a plan to pave this 1.1 mile primary road.

We do appreciate your efforts to date!

4/19/2002

Ray Costic
Bear Valley Homeowner

Response 1-1: The Fish and Wildlife Service is currently exploring management options that would provide it legal access to the entire Bear Valley Road for fire hazard reduction activities and for other management objectives. Among these options include fee-simple acquisition of the road and the purchase of an easement. Regardless of which option is decided upon, the Fish and Wildlife Service will restore access roads to the satisfaction of the landowner following fire hazard reduction activities.

Appendix B

Bear Valley National Wildlife Refuge

Fire Hazard Reduction Project
Environmental Assessment

ERRATA SHEET

1. Page 2-5: The statement in the final bullet point under Section 2.4.3 Wildlife that reads "Prescribed fire units would be limited to 10 acres in size so that burning could be curtailed quickly in the event of a disturbance" is omitted. The current Fire Management Plan for the Klamath Basin National Wildlife Refuge Complex does not reference this mitigation and the Fish and Wildlife Service will employ prescribed fires to meet its fire management objectives and targets whenever possible. The omission of this mitigation measure will not result in any human health and safety or air quality significant impacts.

U.S FISH AND WILDLIFE SERVICE

Finding of No Significant Impact

Fire Hazard Reduction Project

Bear Valley National Wildlife Refuge
Klamath Basin National Wildlife Refuge Complex
4009 Hill Road
Tulelake, CA 96134

The U.S. Fish and Wildlife Service proposes to:

Reduce the fire hazard in the wildland urban interface of the Bear Valley National Wildlife Refuge with manual/mechanical thinning and prescribed fire (approximately 2,400 acres). Excessive tree densities and large accumulations of down woody fuels have dramatically increased the risk of catastrophic wildfire, which could threaten residences adjacent to the refuge and destroy all bald eagle roosting habitat on the refuge. The Service proposes to accomplish some thinning treatments via commercial contracts.

The Service has analyzed a number of alternatives to the proposal, including the following:

1. No Action – hazardous fuel treatments not performed (adhere to current management policy);
2. Thinning and prescribed fire treatments to reduce fire hazard (Preferred Alternative); and
3. Thinning treatments only to reduce fire hazard.

The proposal was selected over the other alternatives because:

A combination of manual/mechanical thinning and prescribed fire would 1) provide the greatest degree of fire hazard reduction, 2) would best protect existing bald eagle nesting and roosting trees and 3) would best promote the future development of trees with preferred roosting and nesting characteristics. This alternative will use an adaptive management approach incorporating the results of on-going monitoring efforts and the advice of bald eagle experts.

Implementation of the preferred alternative would be expected to result in the following environmental and socioeconomic effects:

<u>Environmental</u>

1. Protect existing bald eagle roosting and nesting sites and promote the development of future trees with preferable roosting and nesting characteristics.
2. Forest vegetation would shift toward a more fire-tolerant, shade intolerant set of species; i.e. Douglas fir and ponderosa pine.

3. Ponderosa pine and mixed conifer forest communities would be restored and maintained after thinning and prescribed fire treatments.
4. Thinning and prescribed fire may negatively impact some wildlife individuals, but not threatened and endangered species
5. Soils on the refuge would be enriched from high-frequency, low-intensity prescribed fires.

Socioeconomic

1. By reducing the wildfire threat, public safety and protection of adjacent private property would be enhanced
2. Prescribed fire may negatively impact air quality during periods of burning
3. The local economy would receive some revenues from the commercial timber sales

Measures to mitigate and/or minimize adverse effects have been incorporated into the proposal. These measures include:

Fire Management Activities

1. No handlines exposing mineral soil will be allowed through cultural sites, and all handlines will be rehabilitated. Erosion control methods will be used on slopes exceeding 30% where handline construction takes place;
2. All sites where improvements are made or obstructions removed will be rehabilitated to pre-fire conditions, to the extent practicable;
3. Whenever consistent with safe, effective suppression techniques, the use of natural barriers will be used as extensively as possible;

Soil, Water Resources, and Vegetation

1. Stream crossings will be limited to set and existing locations;
2. Except for spot maintenance to remove obstructions, no improvements will be made to intermittent waterways or clearings in forested areas;
3. Fire lines will be located outside of highly erosive areas, steep slopes, intermittent streams, riparian areas, and other sensitive areas;
4. Fire retardants and foams will not be used in riparian areas;
5. Mechanical thinning (large equipment) will be prohibited within 100 feet of intermittent streams and steep slopes (>35% slope);
6. Mechanical equipment will be restricted in operations to dry or frozen ground (<20% soil moisture);

Wildlife

1. Thinning and prescribed fire operations will be concentrated between August 1 and November 15 to avoid any potential impacts to nesting and/or roosting bald eagles;
2. During the peak roosting period (November 15-April 1), Fish and Wildlife Service personnel may enter the refuge to conduct treatment unit reconnaissance and layout, however, this activity

would only occur in the refuge during the daylight hours when the eagles are not present (approximately between 9:00 am and 3:00pm);

3. During the bald eagle nesting season (April 1-August 1), prescribed fire will be allowed on some stands in the spring months and thinning efforts will be allowed on some stands during the spring and summer months after consultation with and clearance from Fish and Wildlife Service endangered species biologists, and only after meeting the following mitigation measures:
   - Work would be prohibited within ½ mile from active nests;
   - An observer may be stationed on Pearson Butte to watch active nests for any disturbance caused by smoke or noise from thinning and prescribed fire activities;
   - Work would be immediately curtailed in the event that disturbance was observed; and
   - Backing fires would be used when possible to limit smoke production. All burns would be aggressively mopped-up. Burn prescriptions would be written to minimize the potential for high-intensity fire and to avoid severe drought and/or high wind conditions.

Air Quality and Noise

1. Operation of large vehicles associated with thinning efforts will be restricted to daylight hours, generally 8:00 am – 5:00 pm
2. To reduce fugitive dust, access roads will be wetted each day by either the Fish and Wildlife Service or the contractor when hauling operations are being conducted in association with thinning activities;

Transportation

1. Vehicle traffic associated with thinning activities will access and exit the refuge on both the north and south access roads, FWS roads # 10 and 20, respectively;
2. Following the conclusion of thinning activities, road improvements will be made, as necessary, to repair damage to the access roads resulting from vehicle use associated with thinning operations;
3. Vehicles associated with thinning operations will be restricted to a 25-mph speed limit on refuge access roads;

Cultural Resources

1. Prior to all thinning and prescribed fire activities, cultural resources in treatments areas will be identified and avoided;
2. If unrecorded cultural resources are discovered during thinning and prescribed fire activities, all work in the immediate vicinity of the cultural resource will stop until a Fish and Wildlife Service Archeologist surveys and records the location.

The proposal is not expected to have any significant effects on the human environment because:

The treatment area is relatively small (2,400 acres); hazardous fuel treatments would be conducted consistent with the mitigation measures referenced above; public safety and protection of private property will be enhanced; and the viability of eagle roosting habitat will be enhanced.

U.S. FISH AND WILDLIFE SERVICE

Environmental Action Memorandum

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and have determined that the action of:

Manual/mechanical thinning and prescribed fire treatments in the wildland urban interface of the Bear Valley National Wildlife Refuge

is found not to have significant environmental effects as determined by the attached Environmental Assessment and Finding of No Significant Impact.

Other supporting documents:

Section 7 evaluation and concurrence memo
SHPO concurrence letter
Cultural resource inventory at Bear Valley National Wildlife Refuge

Recommended:

(1) _____ 5/23/02
Project Leader Date

(2) _____ 6/12/02
Refuge Supervisor Date

Approved:

(1) Acting _____ 6-12-02
California/Nevada Operations Manager Date

Compatibility Determination

Use: Fire Hazard Reduction

Refuge Name: Bear Valley National Wildlife Refuge

Establishing and Acquisition Authority(ies):

- Acquisition authority for Bear Valley National Wildlife Refuge is derived from 45 Statute 1222, with funds provided by the Land and Water Conservation Fund.

Refuge Purpose(s):

- "...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants..." 16 U.S.C. § 1524 (Endangered Species Act of 1973).

- "...for the development, advancement, management, conservation, and protection of fish and wildlife resources..." 16 U.S.C. § 742f(a)(4) "...for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude..." 16 U.S.C. § 742f(b)(1) (Fish and Wildlife Act of 1956).

- "...suitable for – (1) incidental fish and wildlife oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species..." 16 U.S.C. § 460k-1 (Refuge Recreation Act).

National Wildlife Refuge System Mission:

- The mission of the National Wildlife Refuge System is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

- The U.S. Fish and Wildlife Service proposes to reduce the fire hazard in the wildland urban interface of the Bear Valley National Wildlife Refuge with manual/mechanical thinning and prescribed fire (approximately 2,400 acres). Excessive tree densities and large accumulations of down woody fuels have dramatically increased the risk of catastrophic wildfire, which could threaten residences adjacent to the refuge and destroy all bald eagle roosting habitat on the refuge. Once fuel hazards are reduced, prescribed fire will be used on a rotational basis to keep fuel loads to acceptable levels and move the stand composition toward more fire tolerant species such as ponderosa pine and Douglas fir.

Compatibility Determination Cont.

Availability of Resources:

- Needed resources: Funding for projects covered by the environmental assessment may be available from either wildland urban interface (9264) or hazard fuel reduction (9263) funds made available through the FWS fire management program. Projects will be contracted, so contract administration and unit layout (unit boundary identification, tree marking, GPS) are the only areas needing refuge personnel.

- Revenues: A minimal amount of commercially valuable timber may be harvested during the projects. It is unlikely that significant revenues would be produced as the value of the timber would likely be offset by the costs associated with the projects.

- Adequacy of existing resources: Existing resources are adequate to safely and effectively administer the projects.

- Soliciting outside resources: Assistance with administrating contracts will be solicited from regional Wildland Urban Interface Coordinators.

Anticipated Impacts of the Use:

- Thinning timber stands from below and the use of prescribed fire will reduce the fire hazard on the Bear Valley National Wildlife Refuge and help protect the forest stands from loss to catastrophic wildfire. Reducing hazardous fuel loadings will allow for the use of prescribed fire and move the stand compositions toward more fire-tolerant species composition such as Douglas fir and ponderosa pine. The activities will protect bald eagle nesting and roost trees in the short-term and will promote the long-term sustainability of eagle roosting and nesting habitat on the refuge.

Public Review and Comment:

- Public involvement:

    - A scoping notice describing the proposed action was sent to 47 individuals, organizations, and media outlets. Scoping notices were posted at Midland and Keno post offices, and at the Worden store. Copies of the scoping notice were made available to the representative of a local homeowners group. A scoping notice was posted in the Herald and News newspaper. A public meeting was held in Klamath Falls. Copies of the draft E.A. were mailed to the mailing list. Copies were also made available at the Refuge Headquarters. A legal notice of availability was published in the Herald and News newspaper;

Compatibility Determination Cont.

- The scoping notice was mailed November 16, 2001. Scoping notice was published in Herald and News on November 25, 2001. Public meeting was held on November 28, 2001. Draft E.A.'s were mailed on March 20, 2002. Notice of availability was published in Herald and News on March 22, 2002;

- Scoping comment period lasted from November 25, 2001 to December 13, 2001. Comment period for draft EA lasted from March 22, 2002 to April 22, 2002.

- Comments and responses: Thirteen written comments were received during the scoping period. Two individuals attended the public meeting. One written comment was received in response to the draft E.A. Significant comments from the scoping period centered on cutting trees over 14 inches in DBH and creating fuel breaks. The FWS response to these comments was to set the upper diameter limit on cut trees at 14 inches in DBH, and to eliminate the proposal to create fuel breaks. The one comment for the draft E.A. involved access road issues. The FWS responded by stating that road repairs will be done to the satisfaction of the landowner.

Determination:

____ Use is Not Compatible

_X__ Use is Compatible With Following Stipulations

Stipulations Necessary to Ensure Compatibility:

Thinning and prescribed fire operations will be concentrated between August 1 and November 15 to avoid any potential impacts to nesting and/or roosting bald eagles;

During the peak roosting period (November 15-April 1), Fish and Wildlife Service personnel may enter the refuge to conduct treatment unit reconnaissance and layout, however, this activity would only occur in the refuge during the daylight hours when the eagles are not present (approximately between 9:00 am and 3:00pm);

During the bald eagle nesting season (April 1-August 1), prescribed fire will be allowed on some stands in the spring months and thinning efforts will be allowed on some stands during the spring and summer months after consultation with and clearance from Fish and Wildlife Service endangered species biologists, and only after meeting the following mitigation measures:

- Work would be prohibited within ½ mile from active nests;

- An observer may be stationed on Pearson Butte to watch active nests for any disturbance caused by smoke or noise from thinning and prescribed fire activities;

Compatibility Determination Cont.

- Work would be immediately curtailed in the event that disturbance was observed; and

- Backing fires would be used when possible to limit smoke production. All burns would be aggressively mopped-up. Burn prescriptions would be written to minimize the potential for high-intensity fire and to avoid severe drought and/or high wind conditions.

Justification:

- Purpose(s) and mission: Use supports NWRS mission. Use will restore and maintain forest stands used as bald eagle roosting and nesting habitat.

- Goals, objectives, and refuge management activities: Use supports goals of the refuge. The goals of the Bear Valley NWR are to maintain the health and vigor of the existing bald eagle roost trees, and to create forest stand conditions that will provide additional bald eagle roosting habitat needs in the future.

- Public safety: Use will provide for public safety. A goal of the use is to reduce the potential for wildfires to burn into populated areas. Prescribed fires will only be ignited under a prescription that will limit the potential for escape. Burning will be done at times when atmospheric conditions maximize smoke dispersion. Use will improve firefighter safety. Refuge is closed to all public entry except for walk in during Oregon deer season. This closure limits the potential for the public to be within the area when use occurs.

- Biological resources: Use benefits biological resources. Use will reduce the potential for catastrophic wildfire within the refuge. Use will return fire as a component of a fire dependant ecosystem. Thinning and prescribed fire will enhance existing bald eagle roost trees and favor the establishment of tree species favored by the eagle as roosting habitat.

- Big 6: Use may impact hunters during deer season as projects are implemented. Projects will be limited to portions of the refuge at any given time, and deer hunting opportunities will still exist in areas outside of specific project areas. Thinning and prescribed fire have the potential to increase forage opportunities for deer which may enhance deer hunting in the long term.

Mandatory Re-Evaluation Date:

_____ Mandatory 15-year Re-Evaluation Date (for priority public uses)

____X____ Mandatory 10-year Re-Evaluation Date (for all uses other than priority public uses)

U.S. FISH AND WILDLIFE SERVICE

Environmental Action Memorandum

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and have determined that the action of:

Manual/mechanical thinning and prescribed fire treatments in the wildland urban interface of the Bear Valley National Wildlife Refuge

is found not to have significant environmental effects as determined by the attached Environmental Assessment and Finding of No Significant Impact.

Other supporting documents:

Section 7 evaluation and concurrence memo
SHPO concurrence letter
Cultural resource inventory at Bear Valley National Wildlife Refuge

Recommended:

(1) Philip W Norton 5/23/02
Project Leader Date

(2) Jack S Miller 6/12/02
Refuge Supervisor Date

Approved:

(1) Acting D Kennett 6-12-02
California/Nevada Operations Manager Date

Compatibility Determination Cont.

NEPA Compliance for Refuge Use Decision:

___ Categorical Exclusion without Environmental Action Statement

___ Categorical Exclusion and Environmental Action Statement

_X_ Environmental Assessment and Finding of No Significant Impact

___ Environmental Impact Statement and Record of Decision

Refuge Determination:

Prepared by: Michael R. Glass (Signature) 5/23/02 (Date)

Refuge Manager/ Project Leader Approval: Philip W Norton (Signature) 5/23/02 (Date)

Concurrence:

Origional Signature Page

Pacific Islands Ecoregion Manager (for HI and PI): NA (Signature) ____ (Date)

Refuge Supervisor: Joel S Miller (Signature) 6/12/02 (Date)

Regional Chief, National Wildlife Refuge System: ____ (Signature) ____ (Date)

Acting California/Nevada Operations Manager (for CA and NV): ____ (Signature) 6-12-02 (Date)